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Bangor I-95 Corridor Study 2010

Maine Department of Transportation

Bangor I-95 Corridor Study

Prepared By

Maine Department of Transportation
Bureau of Transportation Systems Planning

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MaineDOT photo by Paul Giguere

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Executive Summary

The Maine Department of Transportation (MaineDOT), along with the Bangor Area Comprehensive Transportation System (BACTS) and other stakeholders, conducted a study of Interstate 95 in the City of Bangor. The purpose of the study was to evaluate the long-term needs of the I-95 Corridor in Bangor and to identify a set of recommendations to provide safe and efficient transportation service through the year 2030.

Background

I-95 was constructed as part of the National System of Interstate and Defense Highways (Interstate Highway System), established by Congress in 1956. Most of present-day I-95 through Bangor was opened to traffic in the early 1960s. Rural Interstate connections to Newport and points south and Orono and points north were opened to traffic in the years following.

Since the 1960s, car and truck traffic volumes on I-95 have grown more than fourfold. In 1963, the I-95 traffic volume over the Kenduskeag Stream was less than 12,000 vehicles per day. Now, I-95 at the same location carries 49,000 vehicles per day, making it the most heavily traveled segment of Interstate highway in Maine north of the Greater Portland area.

MaineDOT's 20-Year Transportation Plan of January 2001 recognized that I-95 through Bangor was a highway corridor in danger of becoming highly congested in the next 20 years. At the same time, MaineDOT's bridge engineers recognized that the I-95 bridges in Bangor were aging and that decisions would need to be made in the coming years on whether the bridges should be rehabilitated or replaced by new bridges. The Bangor I-95 Corridor Study was initiated in late 2007 to evaluate existing and future traffic conditions in the Corridor so that improvement recommendations could be developed that would meet the traffic safety and capacity needed and help guide future decisions on bridge structure maintenance, rehabilitation and replacement.

*Connecting Main*e, MaineDOT's current long-range plan, also identified Maine's Interstate system as a critical factor in the health of Maine's economy and identified it as a strategic investment area. The Bangor I-95 Corridor Study is consistent with the stated goals of *Connecting Maine*:

- *I. Ensure a safe and secure transportation system.*
- *II. Ensure the sustainability of Maine's transportation system.*
- *III. Promote economic viability and competitiveness through transportation investments.*
- *IV. Enhance quality of life by developing and implementing transportation programs that enhance communities and Maine's natural environment.*
- *V. Enhance public awareness and participation.*

Purpose and Need

As stated earlier, the purpose of the study is to evaluate the long-term needs of the I-95 Corridor in Bangor and to identify a set of recommendations to provide safe and efficient transportation service through the year 2030. With the growth of traffic that has occurred in the 50 years of its existence, I-95 is facing greater challenges in meeting the safety and mobility needs of its users. Incidents anywhere along the highway create traffic hazards that can temporarily reduce highway capacity and produce massive traffic backups. On- and off-ramps designed over 50 years ago are operating poorly under today's traffic volumes. The goal of the Bangor I-95 Corridor Study is to provide a direction for future investments in this corridor to address these deficiencies and ensure that I-95 can function effectively into the future.

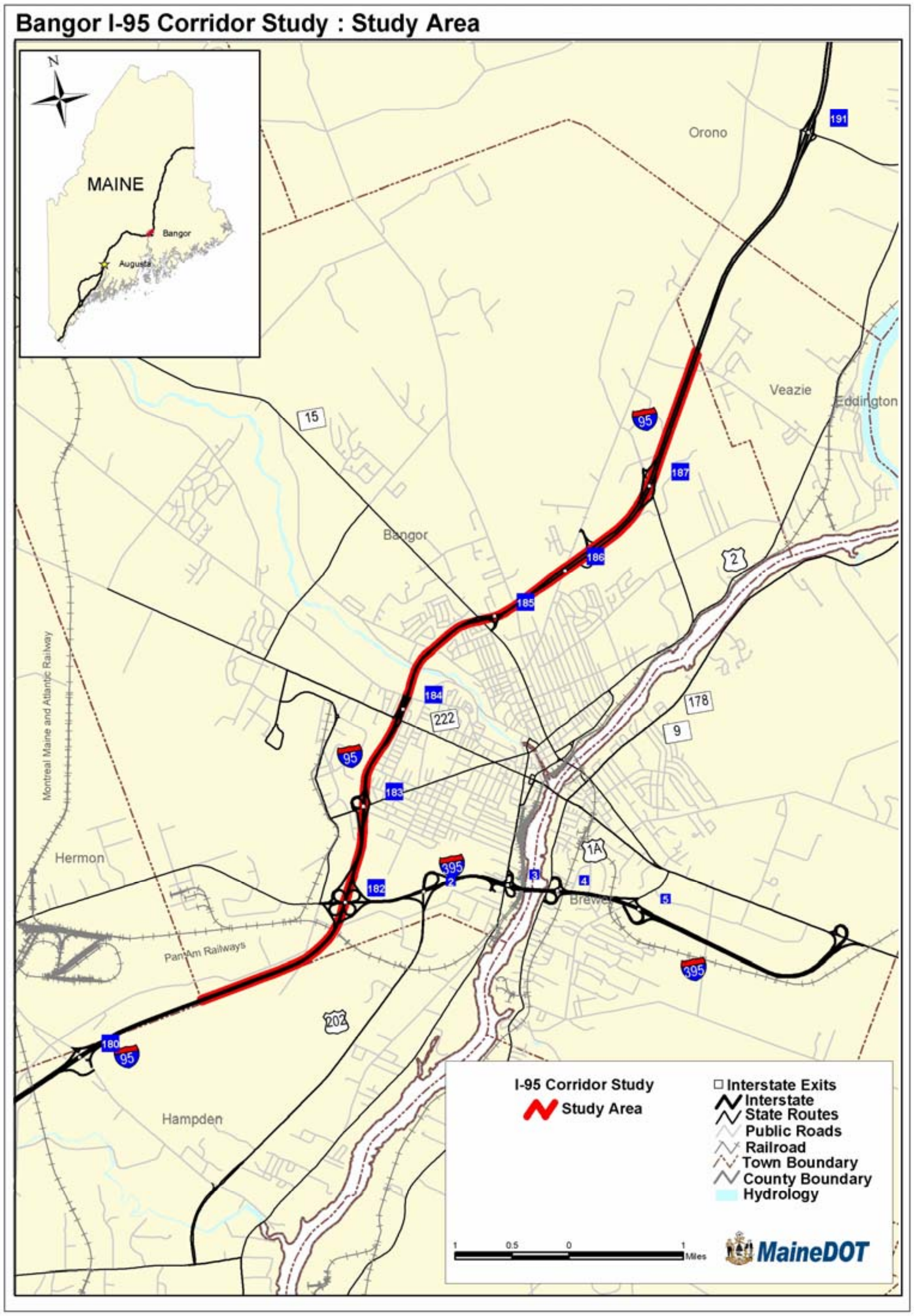
Study Process

After the definition of a study purpose, one of the first steps in the study process was to define a study area for I-95. The Bangor I-95 Corridor Study Area extends the entire length within the City of Bangor from the Hermon town line in the south to the Veazie town line in the north, a distance of 7.5 miles. This study area was chosen because it encompasses the most heavily traveled portions of I-95, from the Exit 182 interchange with I-395 to the Exit 187 interchange at Hogan Road. Figure 1 shows the Bangor I-95 Corridor Study Area.

The study process had two major components: the technical analysis and public participation.

The technical analysis includes a review of existing conditions, a forecast of future conditions, and an analysis of alternatives. The review of existing conditions includes traffic volumes, physical inventory, mobility and safety performance, an inventory of I-95 and related transportation resources, and an environmental overview. The future conditions forecast includes future traffic volumes, mobility performance, and a review of external factors that could influence future conditions. The alternatives are identified from a range of potential strategies, and analyzed to measure their effectiveness and assess their feasibility.

Figure 1 Study Area



Public Participation

The public participation component of the Study included three major elements. The first was a Public Advisory Committee composed of representatives from the following list of entities. The purpose of the Committee was to help identify issues in the I-95 Corridor, offer potential actions, help define future performance expectations, and provide feedback on preliminary findings.

MaineDOT	Federal Highway Administration	Maine State Police
BACTS	City of Bangor	City of Brewer
Bangor Mall	Eastern Maine Medical Center	

A total of four Public Advisory Committee meetings were held between March 2009 and March 2010.

The second element involved a series of public informational meetings held in the City of Bangor. The purpose of these meetings was to give members of the general public the opportunity to receive information during the course of the study, have input on corridor issues, offer potential actions, and provide feedback on preliminary findings. These three public informational meetings were advertised and jointly sponsored by BACTS and MaineDOT and held on May 27, 2009, November 12, 2009, and January 6, 2011.

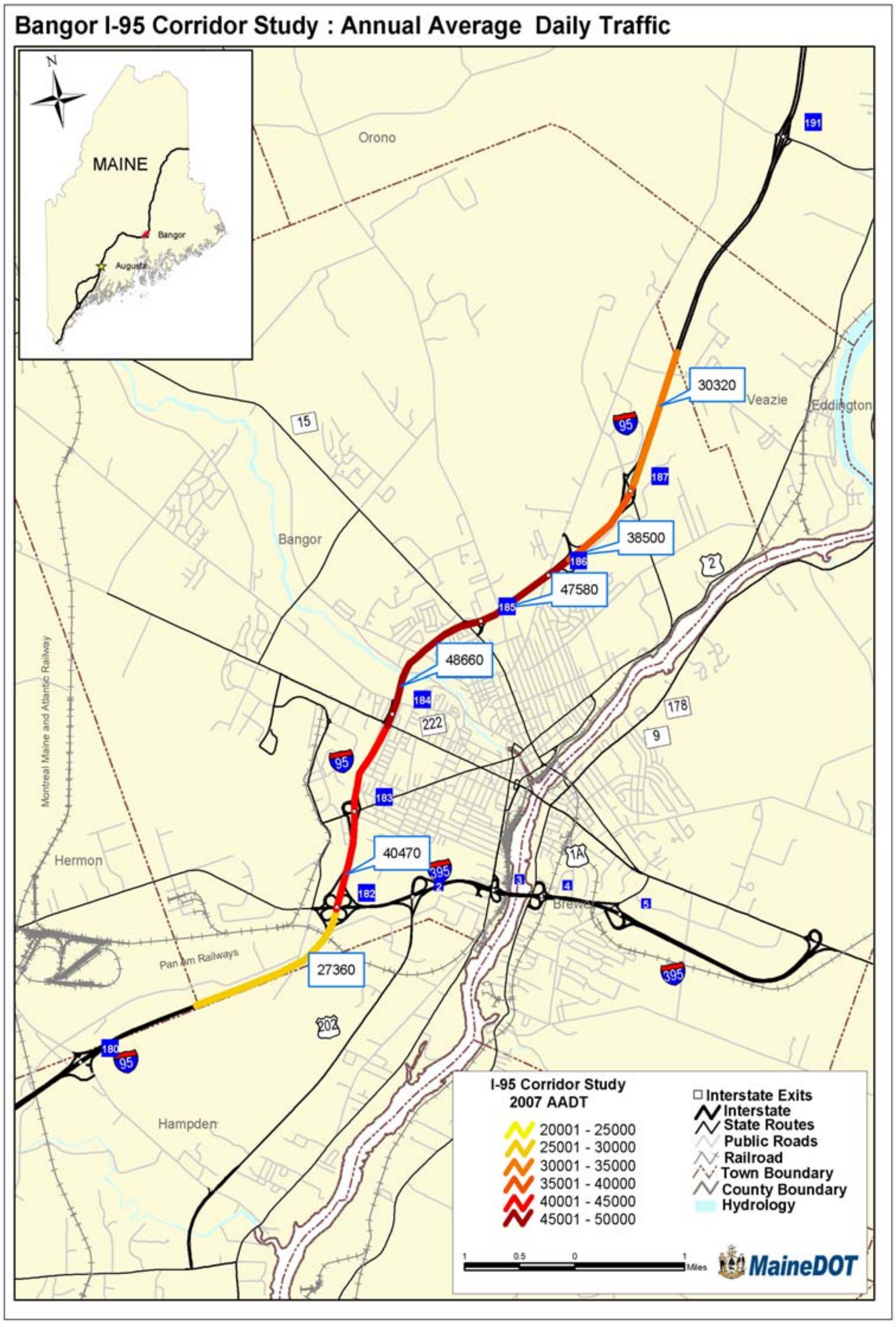
The third element was a Bangor I-95 Corridor Study website to provide information about study objectives, existing and future conditions, Committee meetings, public informational meetings, transportation alternatives, and study findings. The website has provided opportunities for public feedback by way of e-mail messages or by completing an on-line questionnaire about I-95. The website has been accessible from the MaineDOT website at http://www.maine.gov/mdot/bangori95study/index.htm.

Existing and Future Conditions

Baseline information about the Study Area was compiled to provide a picture of the Bangor I-95 Corridor in terms of traffic characteristics, safety, mobility, and environment. In addition to compiling and evaluating this information for existing conditions, traffic volumes, mobility characteristics, and other factors, MaineDOT also looked at changes that could be expected under future conditions.

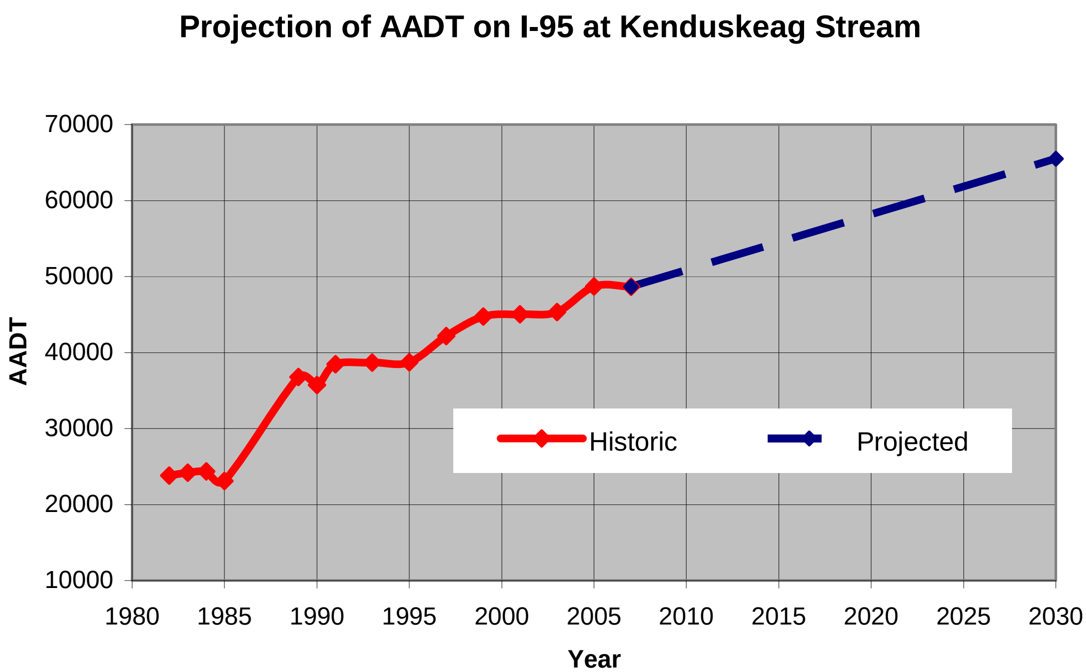
Figure 2 shows the ranges of Annual Average Daily Traffic (AADT) that exist in the I-95 Corridor. Volumes within the Study Area vary from a low of 27,360 vehicles per day south of Exit 182 (I-395) to a high of 48,660 vehicles per day on the segment between Exits 184 (Union Street) and 185 (Broadway). Volumes are nearly as high between Exits 185 and 186 (Stillwater Avenue).

Figure 2 AADT on I-95 in Bangor



Historic trends in traffic growth indicate that traffic volumes in the I-95 Corridor would be expected to continue. Figure 3 shows the historic and projected trend in traffic volume between Exits 185 and 186. Projection of this growth trend suggests a linear growth in traffic at an annual rate of 1.5% from the 2007 base year. Extended to year 2030, the traffic volume on I-95 would increase by 34.5% over the 23-year period.

Figure 3 Bangor I-95 Traffic Projection



Highway Crashes

Highway crash experience is the safety record of a highway facility. Table 1 summarizes the crash experience in years 2005 through 2007 on the Bangor I-95 mainline in terms of numbers of crashes and severities of injury. As the table shows, over 400 crashes occurred, resulting in three fatalities and 128 personal injuries.

Table 1 Crash Experience on Bangor I-95 Mainline , 2005-07

	Injury Type				
	K	A	B	C	PD
Crashes	3	3	53	52	293
Injuries	3	3	65	60	-

Note: Injury Type: K = fatality, A = incapacitating injury, B = non-incapacitating injury, C = possible injury, PD = no injuries (property damage).

Crash data for the same three years were used to identify high crash locations (HCLs) in the Study Area. A HCL is a location that has had eight (8) or more traffic crashes and a Critical Rate Factor (CRF) greater than 1.00 in a three-year period. A highway location with a CRF greater than 1.00 has a frequency of crashes that is greater than the statewide average for similar locations.

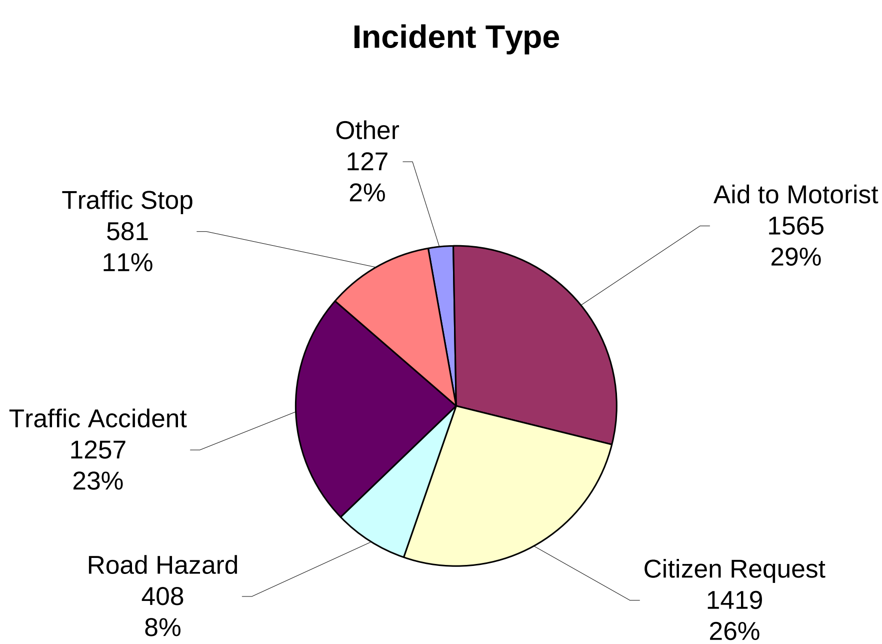
Based on the results of the crash research, fourteen locations within the Study Area meet the criteria for placement on MaineDOT's list of High Crash Locations (HCLs). Collision Diagrams were prepared for these locations to determine if there are any crash patterns or trends evident that may indicate correctable roadway/ intersection deficiencies.

Highway Incidents

Along with the reportable crash data, the MaineDOT received incident data from the Maine State Police. Incidents are defined as accidents, breakdowns and other random events that occur on the highway. They contribute to a large percentage of the traffic congestion delay on the nation's highways, lead to major road closures, and adversely affect the safety of our transportation network. Furthermore, incidents increase drivers' exposure to hazardous conditions and are known to lead to secondary crashes as well.

The Maine State Police reporting system includes details regarding the incident type, location, incident time, time closed and disposition type. During the period from January 2005 to December 2008 there were more than 5,000 incidents reported to the State Police in the study area. Figure 2.16 pie chart shows that largest percentage is Aid to Motorist (29%) followed by Citizen Requests (26%) and Traffic Accidents (23%).

Figure 4 Types of Traffic Incidents on I-95 in Bangor from 2005 through 2008



Freeway Mobility

The mainline segments and ramp junctions along the I-95 Corridor were analyzed for their ability to provide adequate capacity and level of service for existing and future traffic volumes. The analysis of existing and future traffic volumes indicated that these freeway facilities had adequate capacity for now and in year 2030. The analysis of level of service indicated that current levels of service would be level of service C or better, and that future levels of service would be D or better in 2030. A level of service E or F would normally be considered poor. The analysis results led to a determination that additional through lanes on the I-95 Corridor in Bangor would not be needed in the foreseeable future. Tables 2 and 3 show the expected levels of service on mainline segments and ramp junctions for the 2030 AM and PM peak hours, respectively.

Table 2 2030 No-Build LOS AM Peak

		Level of Service					
		A	B	C	D	E	F
On/Off Ramps	South Bound		10	5			
	North Bound		3	3	7		
Segments Between On/Off Ramps	South Bound	2	9	5			
	North Bound		5	5	4		

Table 3 2030 No-Build LOS PM Peak

		Level of Service					
		A	B	C	D	E	F
On/Off Ramps	South Bound		1	10	4		
	North Bound		4	7	2		
Segments Between On/Off Ramps	South Bound		2	10	4		
	North Bound	1	4	7	2		

Intersection Mobility

In addition to analyzing mobility along the I-95 mainline, MaineDOT analyzed the levels of service and capacities at intersections at or near the I-95 interchanges. Table 4 shows a summary of the 2030 operating conditions at these intersections. The analysis showed that the delays at two intersections would lead to level of service E or F in the future.

Table 4 Future Overall Operating Conditions at Intersections

Interchange Location and Intersection		Level of Service	Delay	V/C Ratio
			(sec/veh)	
Exit 182	Outer Hammond and Odlin Rd	E/D	55.3	0.77
Exit 184	I-95 SB and Union	B	14.5	0.67
	I-95 NB and Union	B	16.5	0.75
	14th Street and Union	B	11.5	0.64
Exit 185	Falvey Street and Broadway	B	15.5	0.49
	I-95 SB and Broadway	C	26.8	0.79
	I-95 NB and Broadway	C	22.5	0.78
Exit 186	I-95 and Stillwater Ave	C	32.9	0.85
	Bangor Mall and Stillwater Ave	C	24.8	0.73
Exit 187	Bangor Mall and Hogan Road	F	101.5	0.86
	I-95 SB and Hogan Road	C	22.1	0.78
	I-95 NB and Hogan Road	C	28.7	0.88

Alternatives Analysis

To address safety and mobility concerns in the I-95 Corridor, MaineDOT considered a range of improvement strategies including use of auxiliary lanes, intelligent transportation systems (ITS), transportation demand management (TDM), interchange improvements, and others. Within each of these strategies, specific actions were conceived and analyzed in terms of effectiveness at addressing safety and mobility concerns, capital cost, and implementation challenges.

Effectiveness

In Table 5, the effectiveness of each of the candidate actions is summarized. Each action would have an impact on safety or mobility or both. For auxiliary lane improvements modest improvements would be expected in safety and mobility, but a larger safety impact would be expected where there are high crash locations. For intelligent transportation systems, fewer incidents, shorter incidents, fewer crashes, and reduced delays would be expected. Use of TDM facilities and services would reduce vehicle-miles traveled. In general, improvements at intersections at or near interchanges would reduce delays at those intersections, but could improve safety as well. The major interchange improvement actions would reduce crashes and/or reduce delays on intersecting roads such as Hogan Road. Effective signing improvements would reduce conflicts between vehicles, which affect both safety and mobility. A median barrier would have safety impacts, but it could also reduce maintenance costs.

Table 5 Effectiveness of Actions

Strategies	Actions	Locations	Safety Impact	Mobility Impact
Auxiliary Lanes	Increase acceleration and/or deceleration lengths at interchange ramp junctions	NB 182A off-ramp NB 182B on-ramp NB 183 on-ramp NB 184 off-ramp	reduce vehicle conflicts	minor savings in VHT, some improvements in level of service
		NB 184 on-ramp	address 2 HCLs	
		NB 185 off-ramp	address HCL	
		NB 185 on-ramp	address 2 HCLs	
		NB 187 on-ramp SB 187 on-ramp SB 186 on-ramp SB 185 off-ramp SB 185 on-ramp SB 184 on-ramp SB 183 on-ramp (northern) SB 182A on-ramp	reduce vehicle conflicts	
Intelligent Transportation Systems (ITS)	Establish traffic monitoring facilities	I-95 (and I-395)	reduce crashes on I-95	reduce delays on I-95
	Install variable message signing	I-95 (and I-395)		
	Establish service patrol	I-95 (and I-395)	shorten duration of incidents	
Transportation Demand Management (TDM)	Establish park & ride facility	Exit 185 area		reduce VMT
	Increase carpooling and vanpooling	Greater Bangor area		
Interchange Improvements	Improve intersections at/near interchanges	Exit 182, Odlin @ Outer Hammond		reduce delays
		Exit 185, Broadway @ SB ramps		reduce delays
		Exit 186, Stillwater @ ramps		minor change
		Exit 187, Hogan @ SB off-ramp	address HCL	
		Exit 187, Hogan @ SB on-ramp		reduce delays
	Construct flyover ramp	Exit 182, WB to SB	address 2 HCLs	
	Construct median lanes	Exit 182, NB and SB	address HCL	
	Realign northbound on-ramp	Exit 184	address 3 HCLs	
	Construct northbound on-ramp	Exit 186		mixed results
	Construct new interchange	north of Exit 187		reduce delays
Other	Modify signing	I-95	reduce vehicle conflicts	
	Install median barrier	Between Mile 183 and Mile 186	mixed results	

Costs and Implementation Challenges

Table 6 summarizes the costs and implementation challenges of each action analyzed. For most of the auxiliary lane improvement actions, costs are relatively low and implementation challenges would be minimal. ITS improvement actions would also be low in cost, but would require development and coordination of a freeway management plan. TDM improvement actions would be low in cost, but locating a convenient park & ride lot could be a challenge. Intersection improvement actions at interchanges are moderate in cost, but may involve some right-of-way acquisition. Major interchange improvement actions such as new ramps or a new interchange are the most costly and may involve an extensive planning process if they involve acquiring new right-of-way.

Table 6 Costs and Implementation Challenges

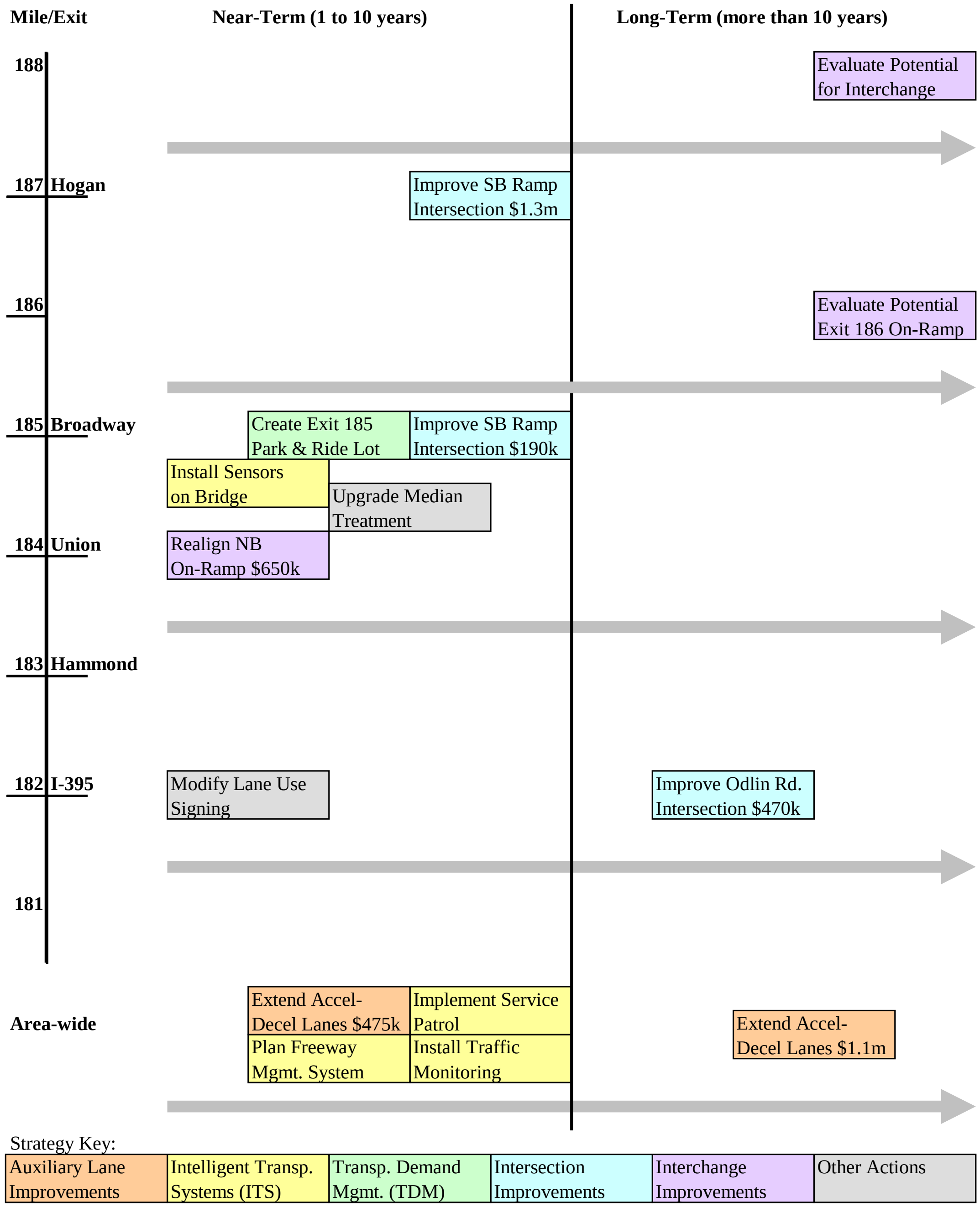
Strategies	Actions	Locations	Capital Cost	Implementation Challenges
Auxiliary Lanes	Increase acceleration and/or deceleration lengths at interchange ramp junctions	NB 182A off-ramp	$75,000	minimal
		NB 182B on-ramp	$85,000	
		NB 183 on-ramp	$175,000	
		NB 184 off-ramp	$90,000	
		NB 184 on-ramp	undetermined	right-of-way and bridge impacts
		NB 185 off-ramp	$70,000	minimal
		NB 185 on-ramp	$140,000	
		NB 187 on-ramp	$130,000	
		SB 187 on-ramp	$130,000	
		SB 186 on-ramp	$130,000	
		SB 185 off-ramp	$70,000	
		SB 185 on-ramp	$160,000	
		SB 184 on-ramp	$110,000	
		SB 183 on-ramp (northern)	$180,000	
		SB 182A on-ramp	$75,000	
Intelligent Transportation Systems (ITS)	Establish traffic monitoring facilities	I-95 (and I-395)	undetermined	implementation plan for freeway management system
	Install variable message signing	I-95 (and I-395)	(in place) $0	
	Establish service patrol	I-95 (and I-395)	(annual) $105,000	
Transportation Demand Management (TDM)	Establish park & ride facility	Exit 185 area	variable	location selection
	Increase carpooling and vanpooling	Greater Bangor area	variable	minimal
Interchange Improvements	Improve intersections at/near interchanges	Exit 182, Odlin @ Outer Hammond	$470,000	possible right-of-way impact
		Exit 185, Broadway @ SB ramps	$190,000	minimal
		Exit 186, Stillwater @ ramps	$690,000	
		Exit 187, Hogan @ SB off-ramp	$300,000	
		Exit 187, Hogan @ SB on-ramp	$1,300,000	
	Construct flyover ramp	Exit 182, WB to SB	$30,000,000	cost, possible right-of-way impact
	Construct median lanes	Exit 182, NB and SB	$15,500,000	cost
	Realign northbound on-ramp	Exit 184	$650,000	coordination with bridge projects
	Construct northbound on-ramp	Exit 186	$5,000,000	cost, mixed mobility impact
	Construct new interchange	north of Exit 187	$9,000,000	cost, environmental effects
Other	Modify signing	I-95	variable	minimal
	Install median barrier	Between Mile 183 and Mile 186	undetermined	potential cost, mixed safety impact

The potential actions were also evaluated and compared with the use of a benefit/cost analysis, which provided indications of which actions were more cost effective and economically feasible. In the development of recommendations from the Bangor I-95 Corridor Study, the effectiveness, the costs, and the implementation challenges all needed to be weighed.

Recommendations

The recommendations from the Study include a mix of actions from several strategies, as shown in Figure 5. Recommended actions have been shown by location along the I-95 Corridor and by a proposed implementation timeline. Those actions identified for implementation within 10 years are considered near-term recommendations. Those actions to be implemented after 10 years are considered long-term recommendations. Implementation of these near-term and long-term recommendations should help I-95 in Bangor operate safely and efficiently well into the future.

Figure 5 Bangor I-95 Corridor Study Recommendations



I Introduction

The Maine Department of Transportation (MaineDOT), along with the Bangor Area Comprehensive Transportation System (BACTS) and other stakeholders, has conducted a study of Interstate 95 in the City of Bangor. The purpose of the study was to evaluate the long-term needs of the I-95 Corridor in Bangor and to identify a set of recommendations to provide safe and efficient transportation service through the year 2030.

A. Background

I-95 was constructed as part of the National System of Interstate and Defense Highways (Interstate Highway System), established by Congress in 1956. Most of present-day I-95 through Bangor was opened to traffic in the early 1960s. Rural Interstate connections to Newport and points south and Orono and points north were opened to traffic in the following years.

Since the 1960s, car and truck traffic volumes on I-95 have grown more than fourfold. In 1963, the I-95 traffic volume over the Kenduskeag Stream was less than 12,000 vehicles per day. Now, I-95 at the same location carries 49,000 vehicles per day, making it the most heavily traveled segment of Interstate highway in Maine north of the Greater Portland area.

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*Connecting Main*e, MaineDOT's current long-range plan, also identified Maine's Interstate system as a critical factor in the health of Maine's economy and identified it as a strategic investment area. The Bangor I-95 Corridor Study is consistent with the stated goals of *Connecting Maine*:

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B. Purpose and Need

As stated earlier, the purpose of the study is to evaluate the long-term needs of the I-95 Corridor in Bangor and to identify a set of recommendations to provide safe and efficient transportation service through the year 2030. With the growth of traffic that has occurred in the 50 years of its existence, I-95 is facing greater challenges in meeting the safety and mobility needs of its users. Incidents anywhere along the highway create traffic hazards that can temporarily reduce highway capacity and produce massive traffic backups. On- and off-ramps designed over 50 years ago are operating poorly under today's traffic volumes. The goal of the Bangor I-95 Corridor Study is to provide a direction for future investments in this corridor to address these deficiencies and ensure that I-95 can function effectively on into the future.

C. Study Process

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1. Technical Analysis

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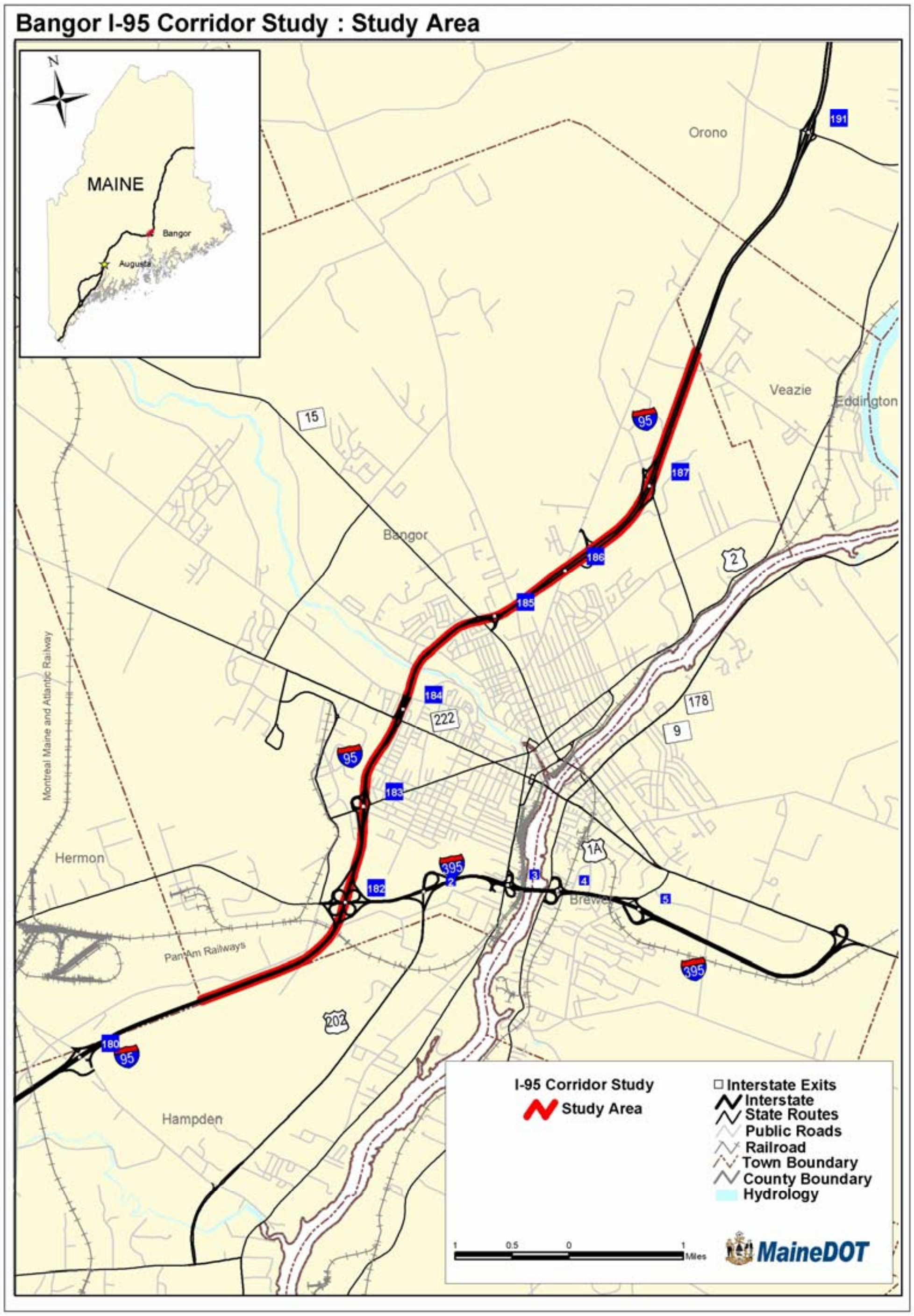
Figure 1.1 Study Area



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The third element was a Bangor I-95 Corridor Study website to provide information about study objectives, existing and future conditions, Committee meetings, public informational meetings, transportation alternatives, and study findings. The website has also provided opportunities for public feedback by way of e-mail messages or by completing an on-line questionnaire about I-95. The feedback has provided useful insight into public perception of I-95. Summarized questionnaire feedback can be found in Appendix 4 of this report. The website has been accessible from the MaineDOT website at http://www.maine.gov/mdot/bangori95study/index.htm.

II Existing Conditions

The analysis of existing conditions provides a detailed description of the current geometric and operating characteristics of the I-95 Corridor. This evaluation required the development of a comprehensive inventory of existing conditions in terms of traffic volume and composition, level of service, roadway geometry, and crash history. It also serves as a benchmark for analyzing future conditions and comparing potential improvement alternatives. An important product of the existing conditions analysis is the identification of geometric and operational deficiencies in the I-95 corridor that adversely affect its ability to serve safely and efficiently. Also important are the identification of other parts of the regional and local transportation systems that interact with the I-95 Corridor and the overview of the environmental conditions along the I-95 Corridor.

A. Traffic Volumes

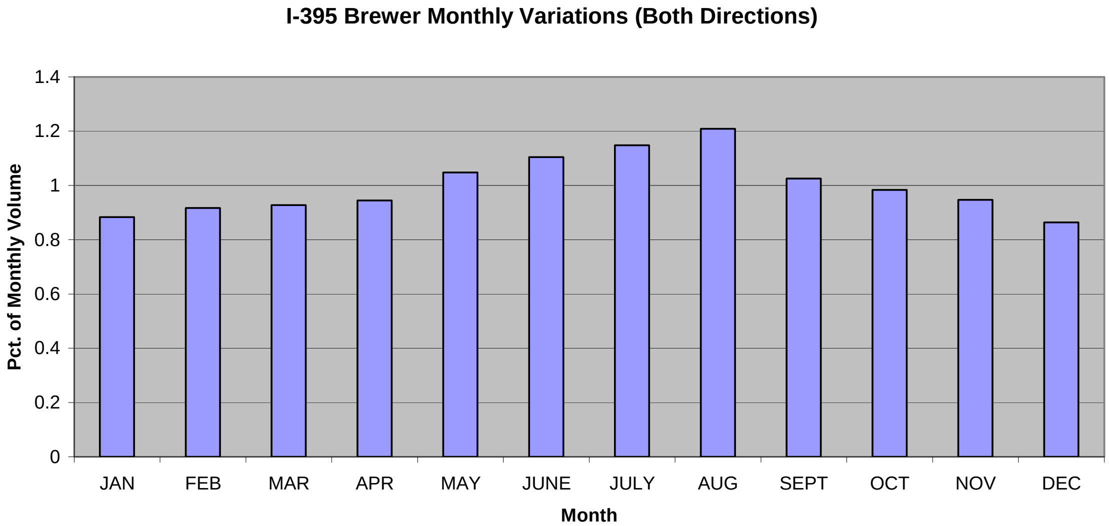
The existing conditions traffic volumes for mainline locations and ramps in the I-95 Corridor were based on counts from 2005 and 2007, collected as part of MaineDOT's normal Interstate traffic counting program. Although there are no permanent traffic counting stations on I-95 in Bangor, the permanent traffic counting station at Exit 4 on I-395 in Brewer provides indications of monthly and daily traffic variations of Interstate highways in the Bangor area.

1. Monthly Variation

A permanent traffic counting station is located on I-395 at the Brewer end of the Penobscot River crossing, less than two miles from I-95. Being the closest permanent urban Interstate counting station to the Study Area, this location provided useful data relating to monthly and daily variations in I-95 traffic flow.

Figure 2.1 shows the monthly variation in the average daily traffic for the year 2007. The Annual Average Daily Traffic (AADT) for the permanent traffic counting station is 30,250. The AADT is the total annual traffic volume divided by the number of days in the year. The peak months are in July and August. The low months are in January and December. Monthly traffic volumes range from a low of 87% of AADT in December to a high of 120% of AADT in August. For some locations on I-95, particularly near Exits 186 and 187, January may be the low month because holiday shopping traffic influences December traffic volumes near major retail districts such as the Bangor Mall area.

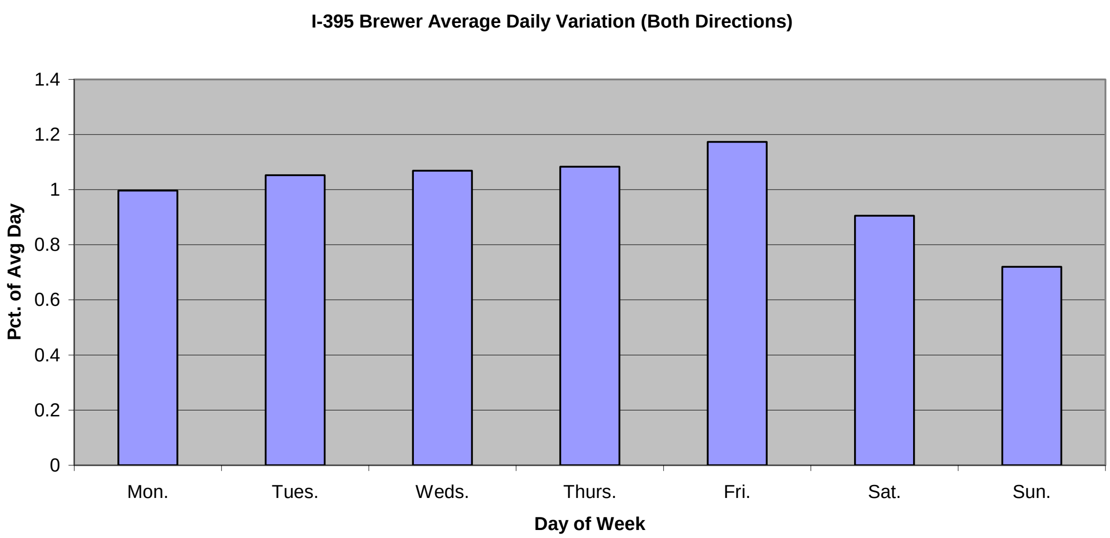
Figure 2.1 I-395 Brewer Monthly Traffic Variation



2. Daily Variation

Figure 2.2 shows the average daily variation for July and August traffic volumes expressed as a percent of the average daily traffic volume. The highest day of the week in both figures is Friday and the lowest two are Saturday and Sunday.

Figure 2.2 I-395 Brewer Daily Traffic Variation

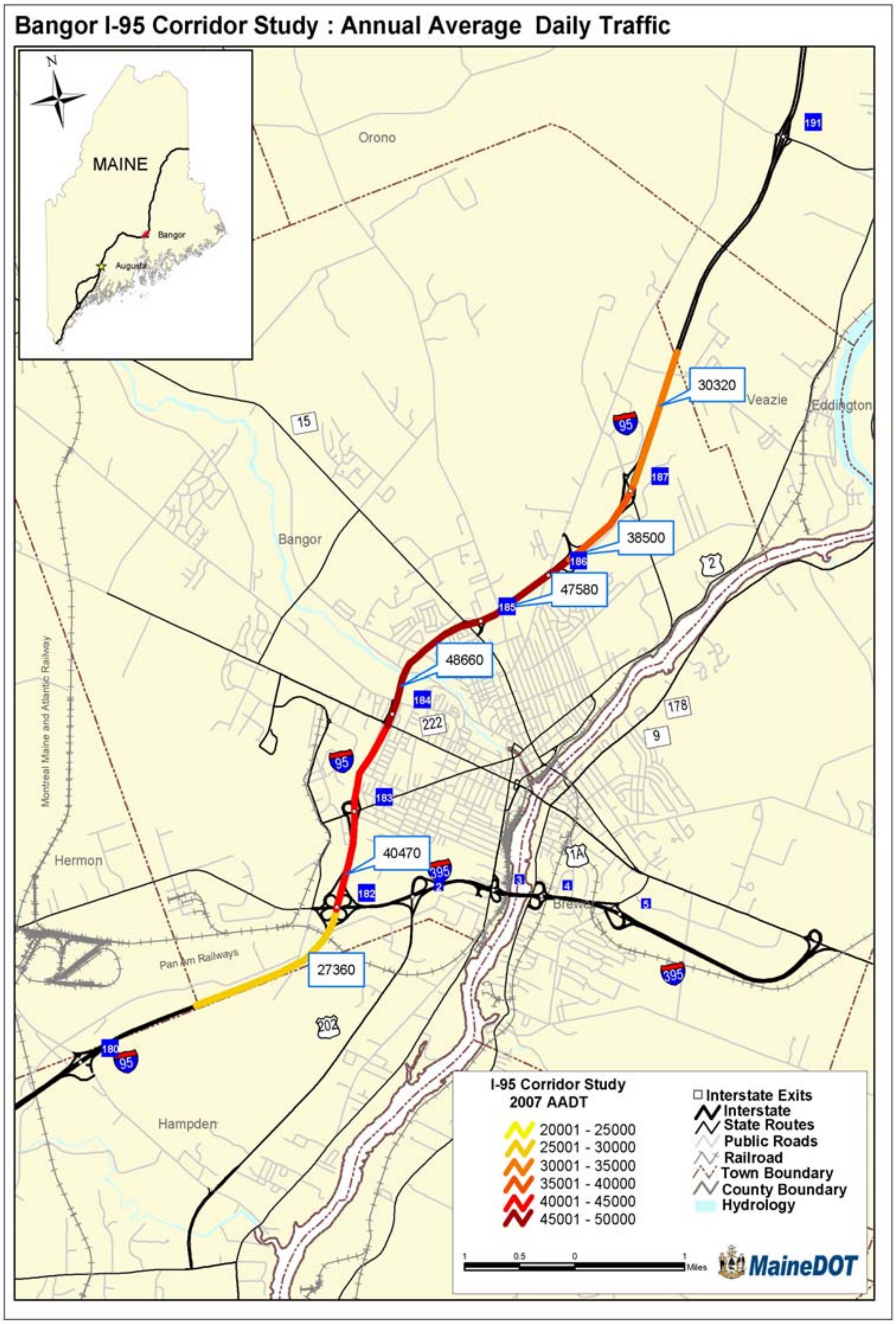


3. Daily Traffic Flows

Traffic volume counts obtained in the corridor Study Area during October of 2005 were used to estimate 2007 Annual Average Daily Traffic (AADT) shown in Figure 2.3. Volumes within the Study Area vary from a low of 27,360 vehicles per day south of Exit

182 to a high of 48,660 vehicles per day on the segment between Exits 184 and 185. Volumes are nearly as high between Exits 185 and 186.

Figure 2.3. AADT on I-95 in Bangor

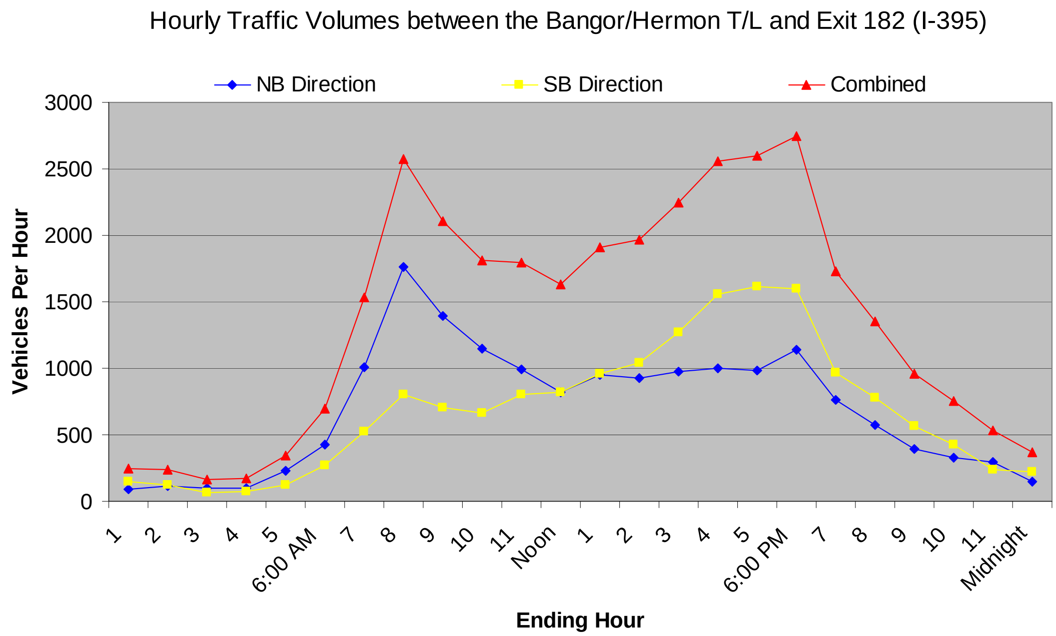


4. Hourly Traffic Variation

Figures 2.4, 2.5, and 2.6 show the hourly variations of I-95 traffic volume on an October weekday in 2005 for northbound and southbound directions.

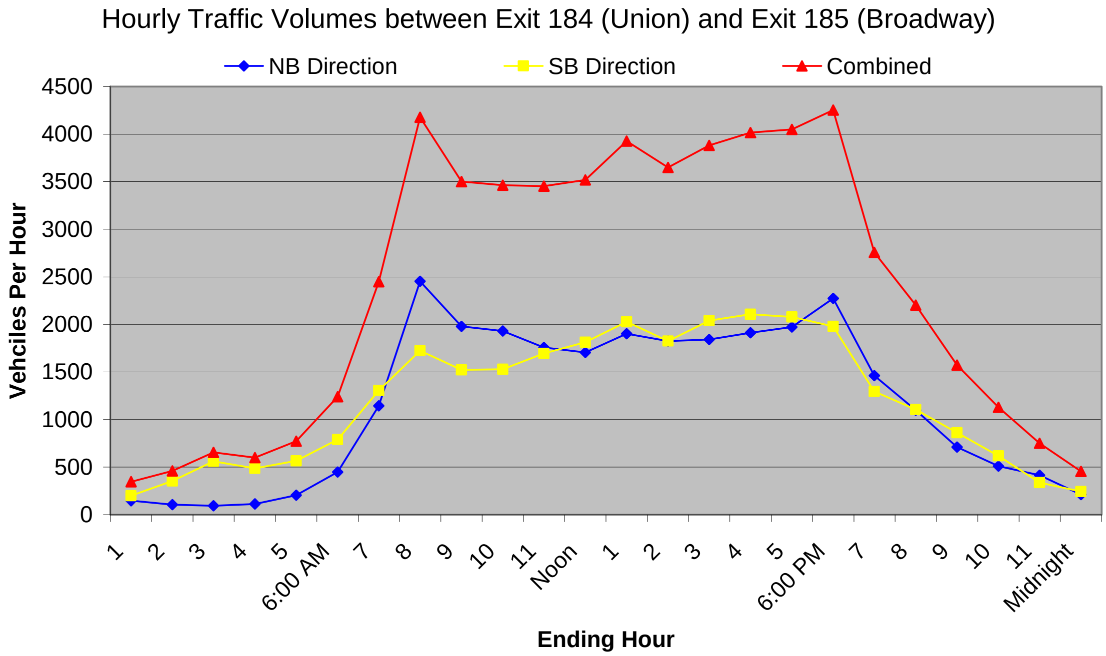
Figure 2.4 shows the hourly traffic distribution for a typical weekday at the southern end of the Study Area. Peak periods of travel occur in the morning during the hour from 7 to 8 AM, and in the afternoon between the hours of 4 and 6 PM. During the morning peak, the directional distribution is greater (over 67%) in the northbound direction into Bangor. During the afternoon peak, the directional distribution is greater (over 58%) in the southbound direction. During the noon hours the directional distribution is around 50 % in each direction. Although the directional distribution is greater in the morning, the peak traffic (over 2600 vehicles per hour) occurs in the afternoon over a longer time period. After 6 PM, the volumes decrease and reach a low of less than 250 vehicles per hour from 2 to 3 AM.

Figure 2.4 Hourly Variation of I-95 Traffic at the Bangor/Hermon Town Line



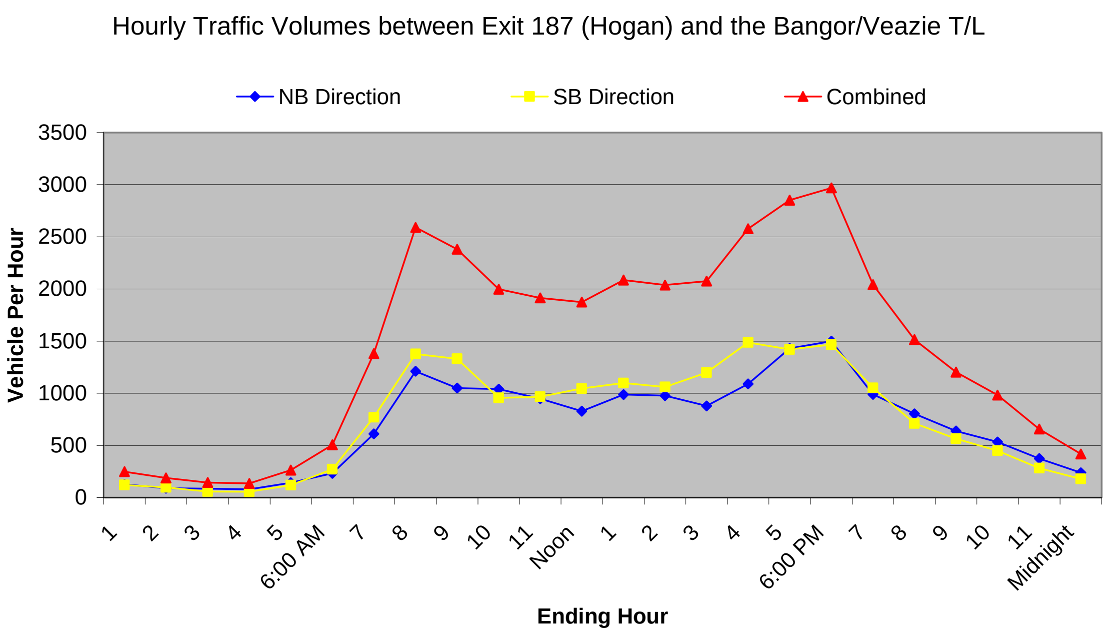
In Figure 2.5, the hourly patterns between Exits 184 and 185 show more balance between northbound and southbound, less pronounced peaks in the morning and afternoon. At this crosstown location, on the most heavily traveled segment in the Study Area, the combined traffic volume is consistently at 3500 vehicles per hour or more from 7 AM to 6 PM.

Figure 2.5 Hourly Variation of I-95 Traffic at the Kenduskeag Stream in Bangor



In Figure 2.6, hourly traffic variation at the northern end of the Study Area shows morning and afternoon peaks in both the northbound (outbound) and southbound (inbound) directions. The morning traffic bound for the University of Maine in Orono may explain the morning peak in the outbound direction.

Figure 2.6 Hourly Variation of I-95 Traffic at the Bangor/Veazie Town Line



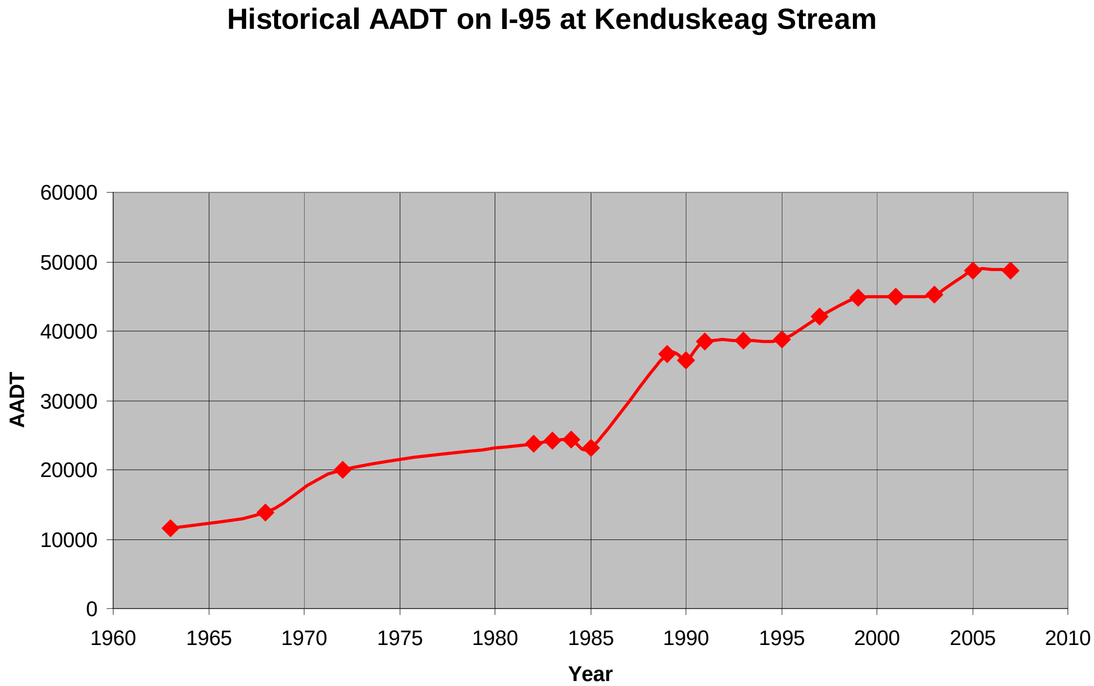
5. Design Hourly Volume

The design policy of the American Association of State Highways and Transportation Officials (AASHTO) recognizes that "Economic considerations in the planning and design of highways make it impractical to design for the highest expected hourly volumes". Instead, a design hourly volume (DHV) is based on the 30th highest hour of the year. The existing DHVs were developed from 24-hour traffic counts (Monday afternoon through Friday morning) obtained in October along the corridor in 2005 and adjusted to July-August levels. Because I-95 is a freeway, a divided highway with access available only at grade-separated interchanges, DHVs were determined for both northbound and southbound directions. For all southbound locations and some northbound locations, the design hour occurs on weekdays between 4 and 5 p.m. For some northbound locations, the design hour occurs on weekdays between 7 and 8 a.m. Given that some locations on I-95 northbound have design hourly volumes during the AM peak, both AM and PM weekday peak conditions were analyzed. Although most traffic counts in the I-95 Corridor were collected in October, year-round count information on I-395 in Brewer enabled PM peak-hour counts to be adjusted to July-August levels to obtain AM and PM DHVs. The AM and PM 2005 DHVs are located in Appendix 2.

6. Historical Traffic Growth

Figure 2.7 below shows the historical growth in traffic over the past 50 years on I-95 at the Kenduskeag Stream crossing in Bangor. The historical data indicates that traffic has continued to grow in the I-95 Corridor, although not always at a uniform rate. The largest increase in traffic volume occurred in the 1980s after I-395 was extended across the Penobscot River to Route 1A in Brewer. The highway extension had a major impact on river-crossing travel patterns and shifted more traffic to the Interstate system, including I-95 as well as I-395. Since 1987, the annual growth in AADT has returned to a steadier slower growth rate.

Figure 2.7 I-95 Bangor Historical Traffic Growth



B. Travel Speeds

To get a clear picture of the speed characteristics of the I-95 Corridor in Bangor, a speed/delay survey was conducted in 2008 for the full length of the Study Area, from the Bangor/Hermon town line to the Bangor/Veazie town line. The two-day survey consisted of 50 or more runs of a survey vehicle traveling with the flow of traffic along the Corridor. Times were recorded at checkpoint locations to calculate the speeds between checkpoints. The data gathered allowed the estimation of average overall, AM peak period, and PM peak period speeds for both northbound and southbound directions along the entire corridor.

Results of the speed/delay survey showed that average speeds in the Study Area are generally consistent for the overall survey, the AM peak, and the PM peak. In the 55 mph zone from Exit 182 to Exit 187, the average speeds remain close to 60 mph. In the 65-mph zones at each end of the Study Area, average speeds are close to 70 mph. Northbound and southbound directions show similar speed patterns. With average speeds exceeding the posted speeds, even during peak periods of traffic, low speeds due to traffic congestion were not present during the survey.

Figure 2. Travel Speeds on I-95 Northbound in Bangor

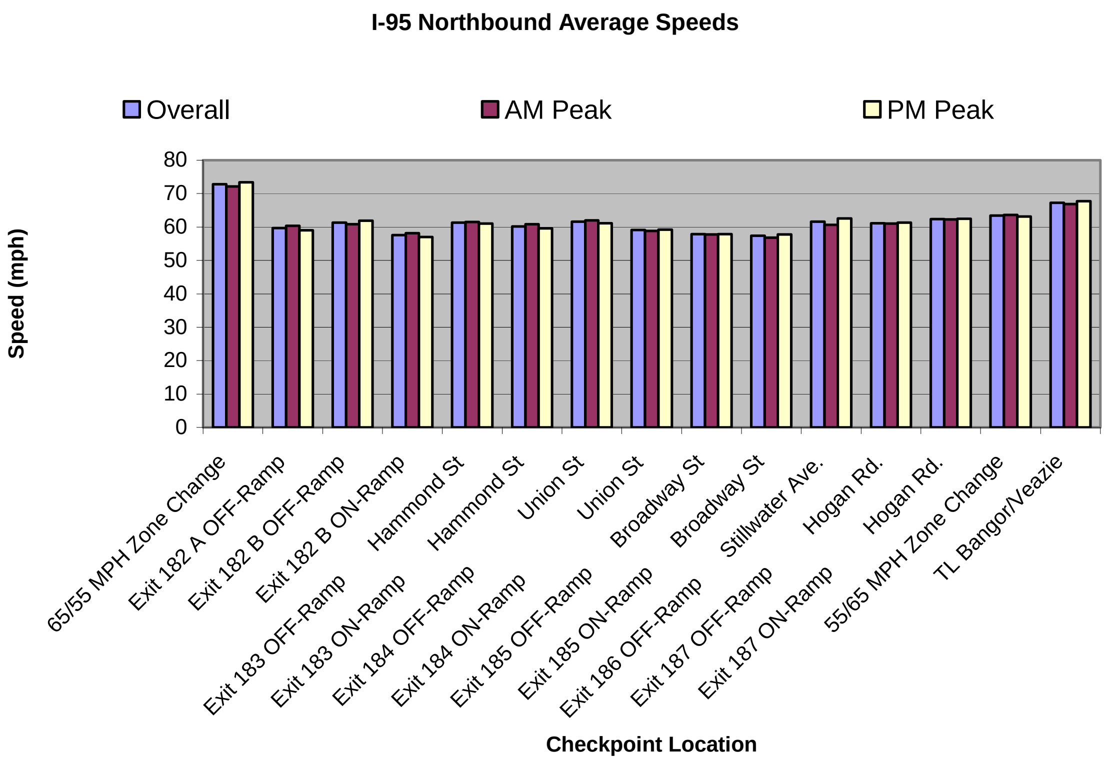
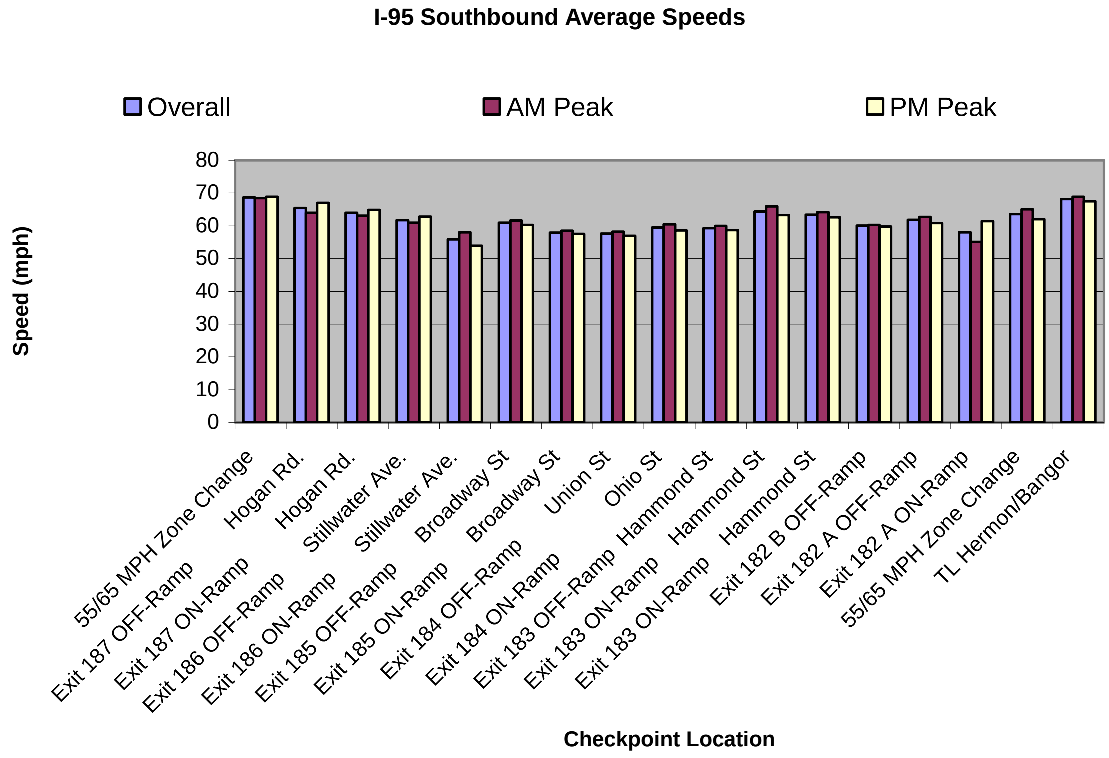


Figure 2. Travel Speeds on I-95 Southbound in Bangor



C. Geometric and Safety Inventory

The safety inventory for the Bangor I-95 Corridor Study consists of readily available baseline information about roadway geometry of the highway, the recent crash record of the highway, and the recent history of reported highway incidents.

1. Roadway Geometry

The existing roadway geometry of the Corridor helps define the potential and the limitations of the existing roadway. The spacing of interchanges, number of lanes, lane and shoulder widths, curvature, and ramp characteristics that went into the design and construction of the facility all affect the capacity of the roadway and the safe speed of operation.

The Bangor I-95 Corridor is approximately 7.5 miles in length, from the Hermon town line to the Veazie town line. The Bangor portion of I-95 was constructed in the late 1950s, early in the Interstate highway building program and before I-95 connections were made between Bangor and points north and south. Throughout the Corridor, the highway has two through lanes in both the northbound and southbound directions. The median width between travel lanes varies from 10 feet to more than 100 feet. Table 2.1 shows typical widths of traveled ways, shoulders, and medians for the I-95 mainline.

Table 2.1 I-95 Roadway Widths in Bangor

Location		Southbound Shoulder (ft)	Southbound Traveled Way (ft)	Median (ft)	Northbound Traveled Way (ft)	Northbound Shoulder (ft)	Length (mi)
From	To						
Bangor/Hermon TL	Odlin Road Underpass	10	24	60	24	10	1.2
Odlin Road Underpass	Exit 182	10	24	36	24	10	0.4
Exit 182 (Bridge/Weave)		2	36	36	36	2	0.1
Exit 182	Exit 183	10	36	36	24	10	0.2
Exit 183	Exit 184	10	24	36 to 16	24	10	0.3
Exit 184	Kenduskeag Stream	10	24	16 to 10	24	10	1.1
Kenduskeag Stream Overpass		2	24	10	24	2	0.1
Kenduskeag Stream	Exit 185	10	24	10 to 16	24	10	0.7
Broadway Overpass		10	24	16	24	2	0.1
Exit 185	Exit 186	10	24	16 to 120	24	10	0.7
Stillwater Overpass		2	24	120	24	2	0.1
Exit 186	Exit 187	10	24	120	24	10	0.5
Exit 187	Bangor/Veazie TL	10	24	120	24	10	2.0

Traveled way widths in the Corridor are generally consistent, while widths of shoulders and medians vary by location. The northbound and southbound traveled ways are typical 24 feet for each, accommodating two 12-foot lanes. Exceptions are the three weaving sections two at Exit 182 and one between Exits 183 and 182 in the southbound direction. Outside shoulder widths are normally 10 feet, with the exception of bridges over other features where the shoulder width is normally 2 feet. The median width (between the yellow lines at the edge of the traveled ways) varies from 10 feet near the Kenduskeag Stream overpass and 60 feet or more near the ends of the Study Area. Two miles of I-95 have a median width of 16 feet or less.

Table 2.2 shows the acceleration and deceleration lengths as measured for highway capacity analysis. The length of the acceleration and deceleration lane has a significant effect on merging and diverging operations. Short lanes provide on-ramp vehicles with restricted opportunity to accelerate before merging and off-ramp vehicles with less opportunity to decelerate off-line. The result is that most acceleration and deceleration must take place on the mainline, which disrupts through vehicles. Short acceleration lanes also force many entering vehicles to slow significantly and even stop while seeking an appropriate gap in the mainline traffic stream. Many of the older on- and off-ramps in the Study Area are too short for today's standards and were not designed for current day ramp volumes.

Table 2.2 Accel/Decel Lengths for I-95 On- and Off-Ramps

<table>
<tr><th>I-95 Direction</th><th>Interchange Exit #</th><th>Interchange Arterial</th><th>On/Off Ramp</th><th>Existing Accel/Decel Length (feet)</th></tr>
<tr><td rowspan="13">Northbound</td><td rowspan="2">182A</td><td rowspan="2">I-395 EB</td><td>Off</td><td>250</td></tr>
<tr><td>On</td><td rowspan="2">565 (weaving section)</td></tr>
<tr><td rowspan="2">182B</td><td rowspan="2">I-395 WB</td><td>Off</td></tr>
<tr><td>On</td><td>450</td></tr>
<tr><td rowspan="2">183</td><td rowspan="2">Hammond</td><td>Off</td><td>300</td></tr>
<tr><td>On</td><td>250</td></tr>
<tr><td rowspan="2">184</td><td rowspan="2">Union</td><td>Off</td><td>150</td></tr>
<tr><td>On</td><td>200</td></tr>
<tr><td rowspan="2">185</td><td rowspan="2">Broadway</td><td>Off</td><td>375</td></tr>
<tr><td>On</td><td>150</td></tr>
<tr><td>186</td><td>Stillwater</td><td>Off</td><td>400</td></tr>
<tr><td rowspan="2">187</td><td rowspan="2">Hogan</td><td>Off</td><td>300</td></tr>
<tr><td>On</td><td>325</td></tr>
<tr><td rowspan="15">Southbound</td><td rowspan="2">187</td><td rowspan="2">Hogan</td><td>Off</td><td>300</td></tr>
<tr><td>On</td><td>300</td></tr>
<tr><td rowspan="2">186</td><td rowspan="2">Stillwater</td><td>Off</td><td>330</td></tr>
<tr><td>On</td><td>360</td></tr>
<tr><td rowspan="2">185</td><td rowspan="2">Broadway</td><td>Off</td><td>260</td></tr>
<tr><td>On</td><td>340</td></tr>
<tr><td rowspan="2">184</td><td rowspan="2">Union/Ohio</td><td>Off</td><td>320</td></tr>
<tr><td>On</td><td>315</td></tr>
<tr><td>183</td><td rowspan="3">Hammond</td><td>Off</td><td>300</td></tr>
<tr><td>183B</td><td>On</td><td>465</td></tr>
<tr><td>183A</td><td>On</td><td rowspan="2">1070 (weaving section)</td></tr>
<tr><td rowspan="2">182B</td><td rowspan="2">I-395 WB</td><td>Off</td></tr>
<tr><td>On</td><td rowspan="2">565 (weaving section)</td></tr>
<tr><td rowspan="2">182A</td><td rowspan="2">I-395 EB</td><td>Off</td></tr>
<tr><td>On</td><td>500</td></tr>
</table>

Shaded areas represent acceleration or deceleration lanes that are more than 50 ft short of a suggested accel length of 600 ft for on-ramps, or a suggested decel length of 340 ft for off-ramps.

2. Highway Crashes

Highway crash experience is the safety record of a highway facility. Table 2.3 summarizes the crash experience in years 2005 through 2007 on the Bangor I-95 mainline in terms of numbers of crashes and injuries severity. As the table shows, over 400 crashes occurred during the three years, resulting in three fatalities and 128 personal injuries.

Table 2.3 Crash Experience on Bangor I-95 Mainline, 2005-07

	Injury Type				
	K	A	B	C	PD
Crashes	3	3	53	52	293
Injuries	3	3	65	60	-

Note: Injury Type: K = fatality, A = incapacitating injury, B = non-incapacitating injury, C = possible injury, PD = no injuries (property damage).

Crash data for the same three years were used to identify high crash locations (HCLs) in the Study Area. A HCL is a location that has had eight (8) or more traffic crashes and a Critical Rate Factor (CRF) greater than 1.00 in a three-year period. A highway location with a CRF greater than 1.00 has a frequency of crashes that is greater than the statewide average for similar locations.

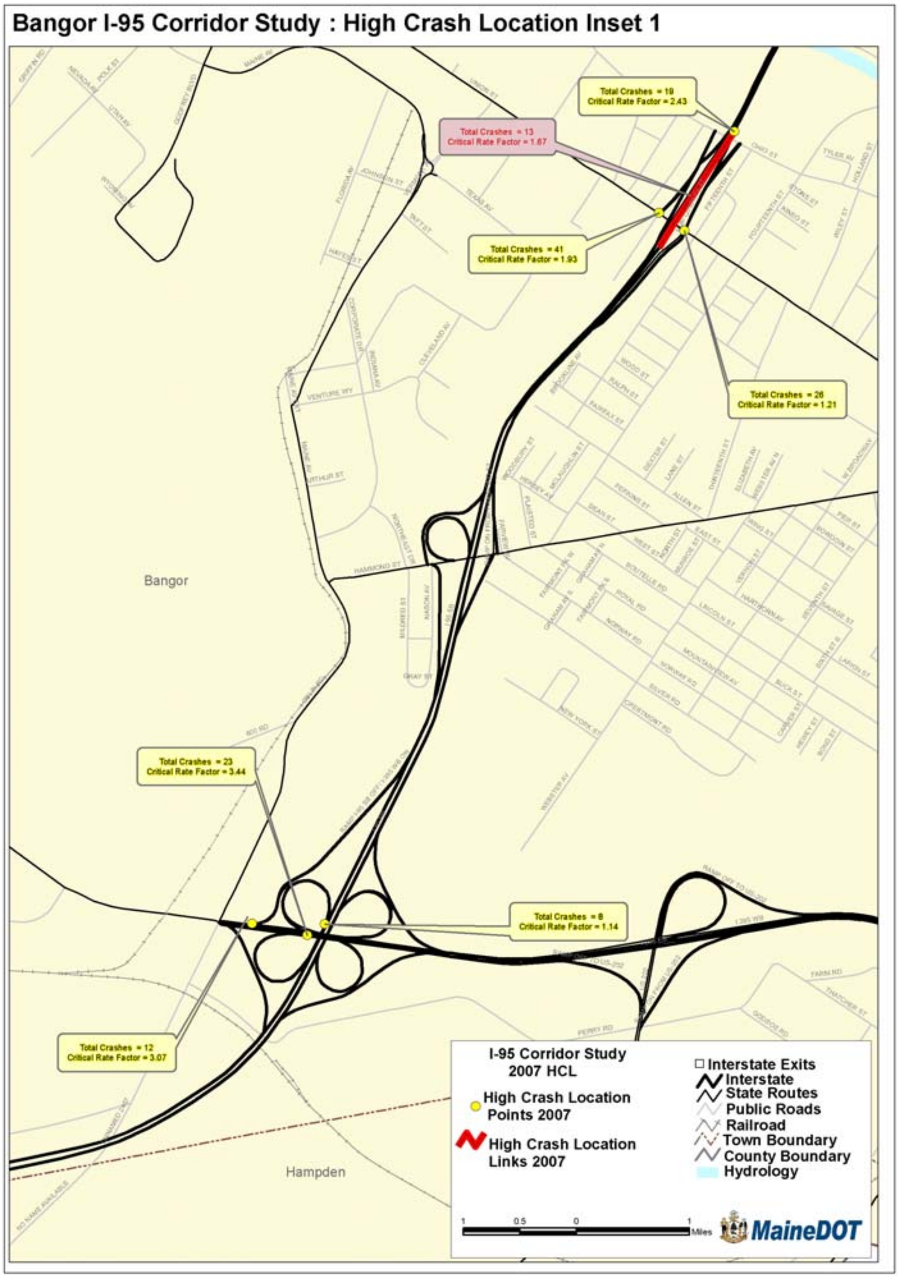
Based on the results of the crash research, 14 locations within the Study Area meet the criteria for placement on MaineDOT's list of High Crash Locations (HCLs). Collision diagrams were prepared for these locations to determine if there are any crash patterns or trends evident that may indicate correctable roadway/ intersection deficiencies. These diagrams are provided in Appendix 1. Table 2.4 lists each HCL, the number of crashes, injury type and the CRF for the Study Area intersections and road segments. Figure 2.14, 2.15, and 2.16 show the HCL locations.

Table 2.4 High Crash Locations, 2005-07

Location	Total Crashes	Injury Type					Percent Injury	CRF
		K	A	B	C	PD		
Exit 182 - I-395 WB On-Ramp from I-95 SB	12	0	0	2	5	5	58.3	3.07
Exit 182 - I-95 SB On-Ramp from I-395 WB	8	0	0	1	1	6	25.0	1.14
Exit 182 - I-395 EB On-Ramp from I-95 SB	23	0	0	6	5	12	47.8	3.44
Exit 184 - Intersection of I-95 NB Ramp with Union St.	26	0	2	2	5	17	34.6	1.21
Exit 184 - I-95 NB On-Ramp	19	0	0	4	1	14	26.3	2.43
Exit 184 - Intersection of !-95 SB Ramp with Union St.	41	0	0	6	7	28	31.7	1.93
Exit 185 - I-95 NB On-Ramp	9	0	0	3	1	5	44.4	1.17
Exit 187 - Intersection of I-95 NB Ramp with Hogan Rd.	38	0	1	3	11	23	39.5	1.03
Exit 187 - Intersection of I-95 SB Ramp with Hogan Rd.	8	0	0	1	3	4	50.0	1.70
I-95 NB Mainline Exit 182 to 183	14	0	0	3	1	10	28.6	1.77
I-95 NB Mainline Exit 183 to 184	33	0	0	2	4	27	18.2	1.53
I-95 NB Mainline Exit 184 to 185	25	0	0	3	2	20	20.0	1.08
I-95 SB Mainline North of Exit 187	18	0	0	4	2	12	33.3	1.17

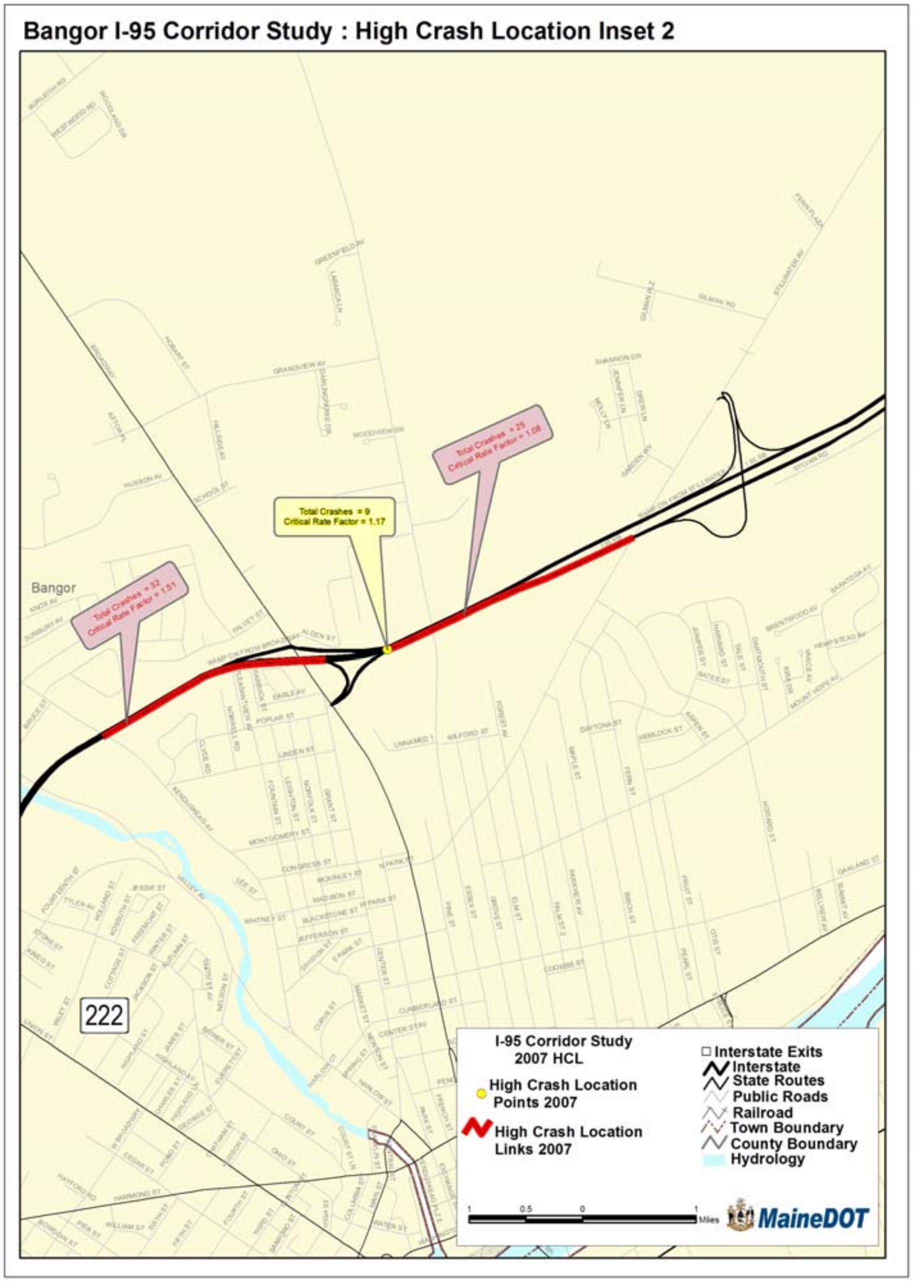
Note: Injury Type: K = fatality, A = incapacitating injury, B = non-incapacitating injury,
C = possible injury, PD = no injuries (property damage).

Figure 2.14 High Crash Locations from Exit 182 through Exit 184



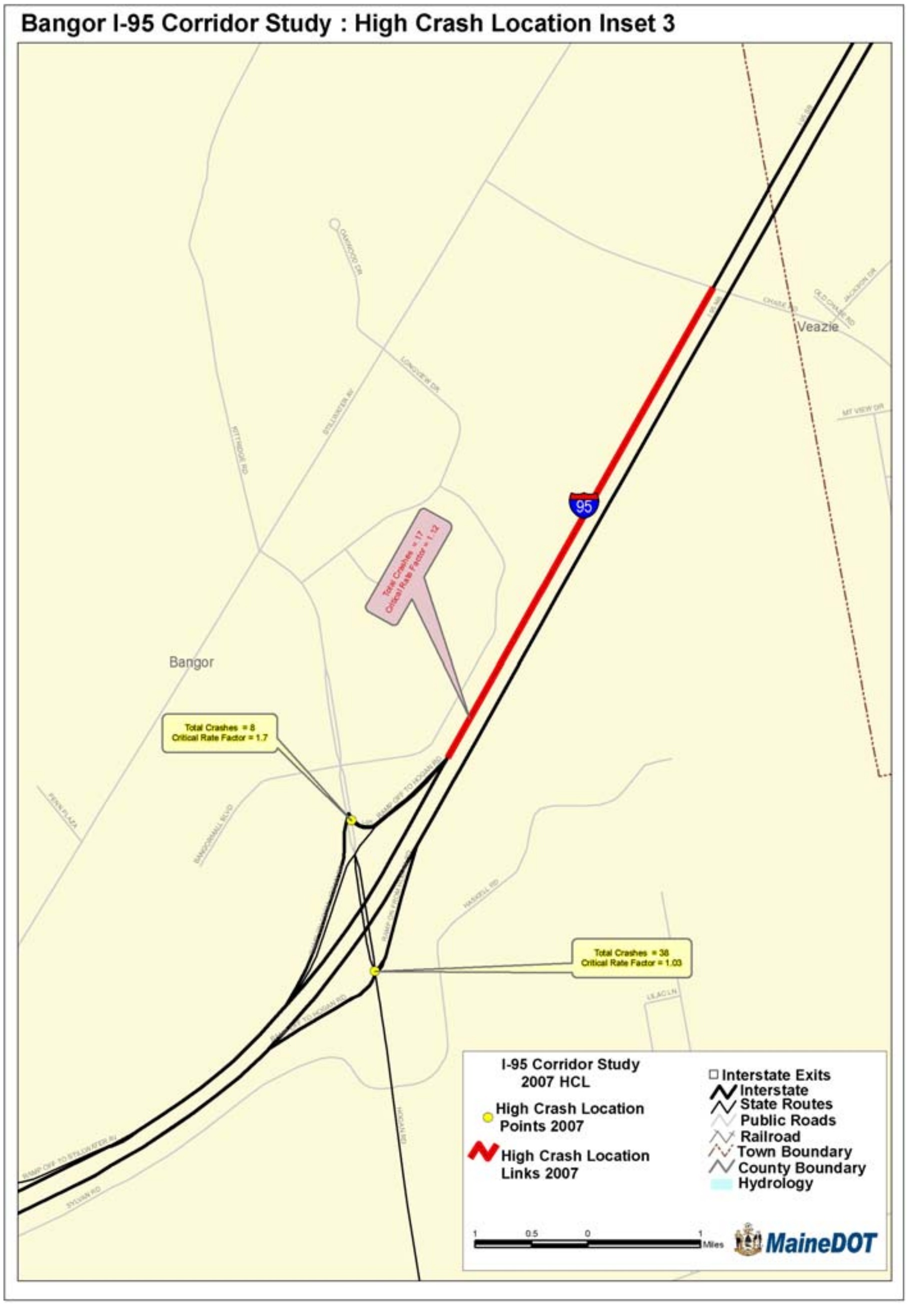
In the southern portion of the Study Area, HCLs are concentrated at Exit 182 and 184. At Exit 182, the HCLs are all at the merge points of ramps at the I-395 interchange. At Exit 184, two HCLs are on the Union Street intersections with the interchange ramps, while the other two are at the merge point of the northbound on-ramp with the I-95 mainline. There are no HCLs at Exit 183 and at the crossing of the on- and off-ramps at Exit 184. Many of the crashes at the ramp junctions are rear-end crashes.

Figure 2.15 High Crash Locations between Exit 184 and Exit 186



All of the HCLs in the middle portion of the Study Area are in the northbound direction. They are located on the I-95 mainline upstream and downstream of Exit 185 and at the merge point of the northbound on-ramp and the mainline. Many of the mainline crashes are rear-end or run-off-the-road crashes, involving construction zones or slippery road conditions.

Figure 2.16 High Crash Locations North of Exit 186



Two of the three HCLs in the northern portion of the Study Area are located at Exit 187 off-ramp intersections with Hogan Road. The other HCL is on the southbound mainline north of Exit 187. The intersection crashes are mostly rear-end and angle collisions. The mainline crashes involve mainly slippery roads, large animals crossing, or construction zones.

3. Highway Incidents

Along with the reportable crash data, MaineDOT received incident data from the Maine State Police. Highway incidents are accidents, breakdowns and other random events that occur on the highway. They contribute to a large percentage of the traffic congestion delay on the nation's highways, lead to major road closures, and adversely affect the safety of our transportation network. Highway incidents increase drivers' exposure to hazardous conditions and are known to lead to secondary crashes as well.

The Maine State Police reporting system includes details regarding the incident type, location, incident time, time closed and disposition type. During the four-year period from January 2005 to December 2008 there were a total of 5,357 incidents reported to the State Police in the Study Area.

Figure 2.16 pie chart shows that largest percentage is Aid to Motorist (29%) followed by Citizen Requests (26%) and Traffic Accidents (23%).

Figure 2.16 Highway Incidents by Type, 2005-08

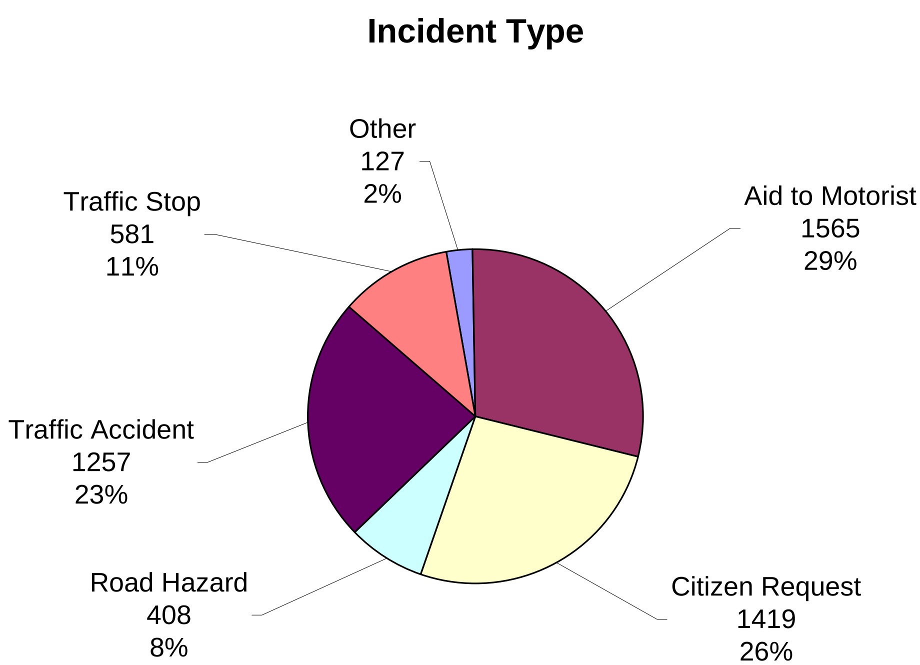


Figure 2.17 shows the monthly incident variation along the Study Area for both northbound and southbound directions during the four-year period. The highest frequency month was December with an average of 144 incidents per month. The lowest frequency month was April, with an average of 101 incidents per month.

Figure 2.17 Monthly Incident Variation, 2005-08

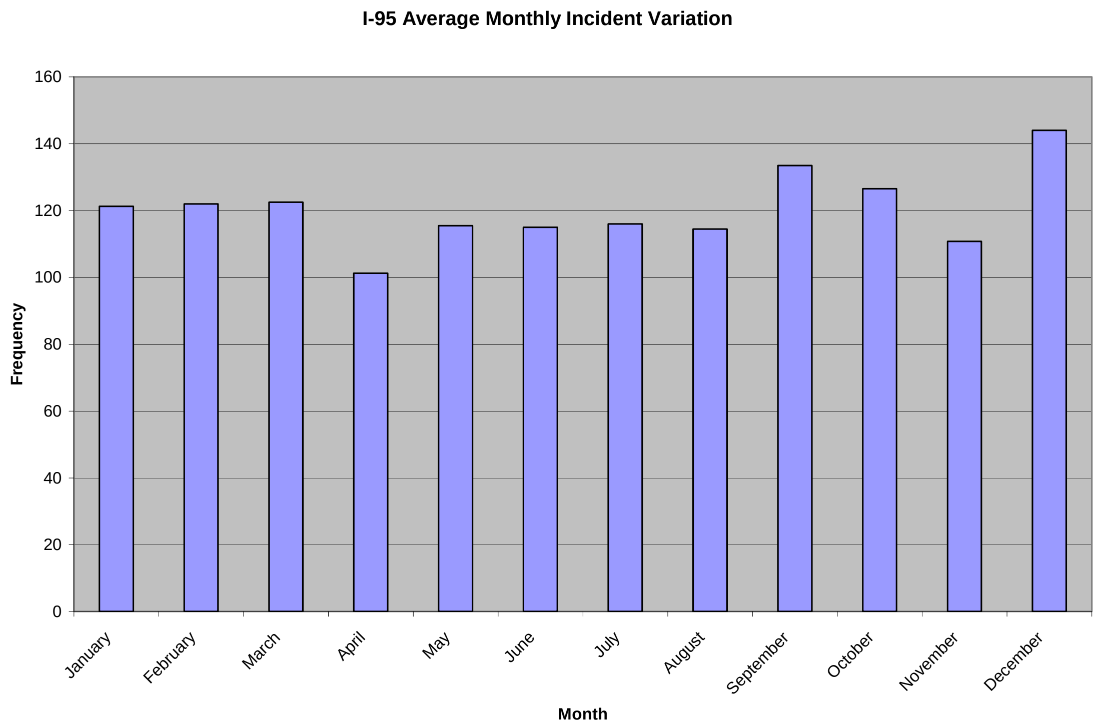


Figure 2.18 shows the daily incident variation along the study area for both northbound and southbound directions during the four-year period. The total number of incidents during each day of the week was relatively consistent. The highest frequency occurred on Friday (1062), and the lowest frequency occurred on Sunday (569).

Figure 2.19 shows the hourly incident variation along the study area for both northbound and southbound directions. The peak hours of incidents were between 2 PM and 5 PM. Each of those three hours accounted for 450 to 500 incidents during the four-year period.

Figure 2.18 Daily Incident Variation, 2005-08

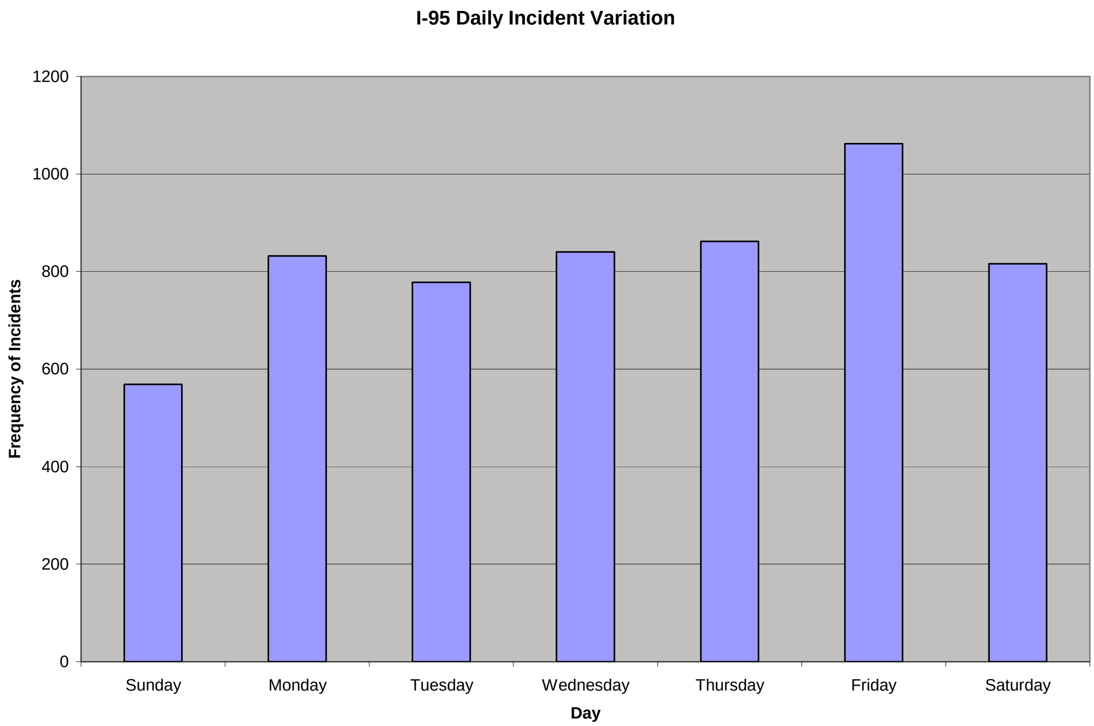


Figure 2.19 Hourly Incident Variation, 2005-08

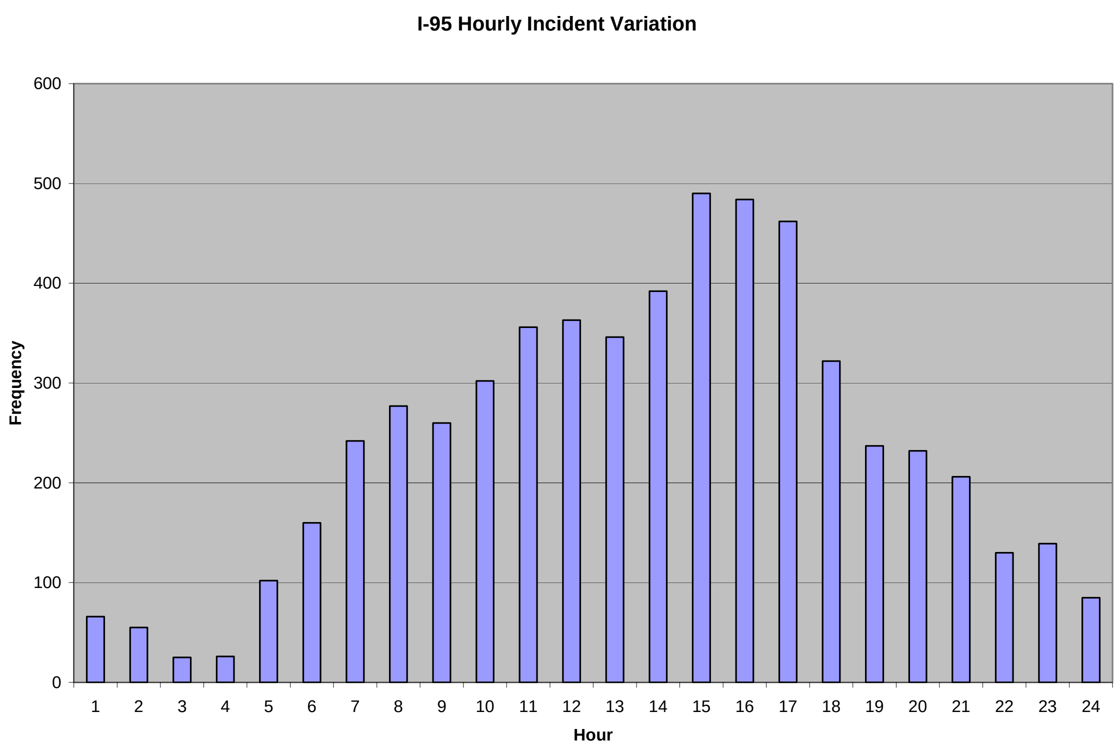
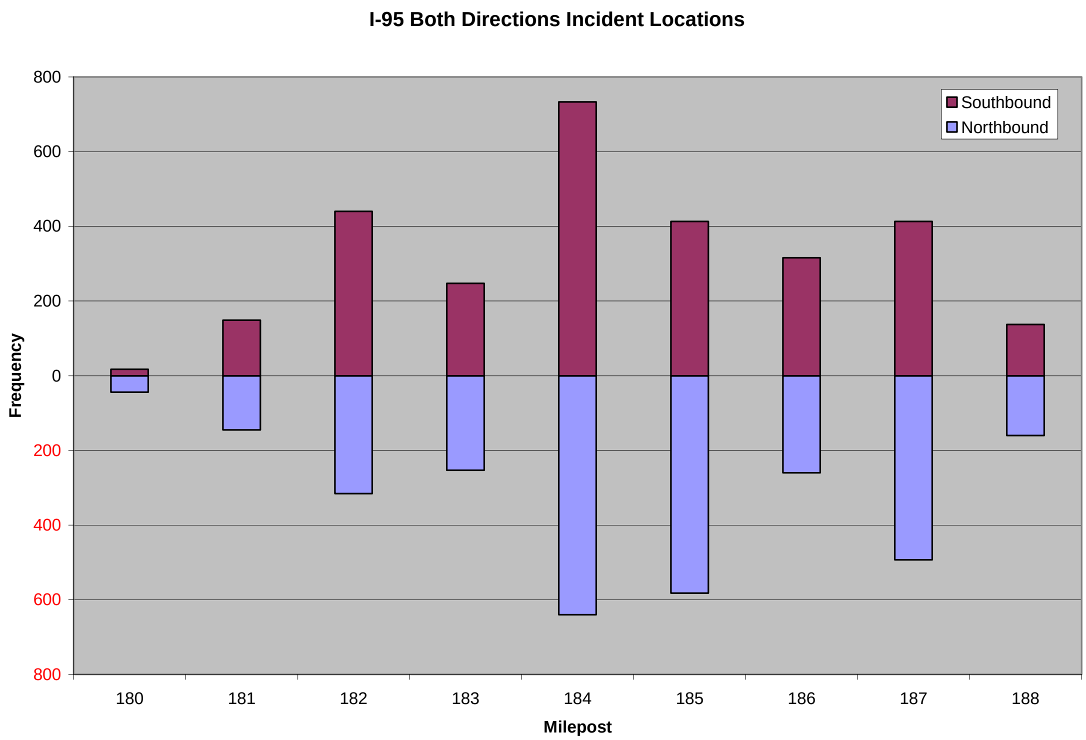


Figure 2.20 shows a combination of both northbound and southbound total incidents. The northbound is in blue bars and the southbound is in dark red bars The miles with the highest number of incidents are those with interchanges (miles 182 to 187). The ramps at interchanges are often where crashes occur. Ramps at interchanges also may be serve as refuges for disabled or stopped vehicles. Mile 184 had the highest number of incidents for both the northbound and southbound directions.

Figure 2.20 Northbound and Southbound I-95 Incidents by Milepost, 2005-08



D. Mobility and Operating Conditions

A major element of the I-95 Corridor Study is the evaluation of operating conditions along I-95 in terms of traffic mobility. To assess mobility, capacity and level of service analyses were conducted using the current edition of the Highway Capacity Manual (HCM 2000).

While a major focus of the analysis of mobility is for freeway facilities, intersections at or near interchanges are also an important part of the analysis. The HCM 2000 has methods for analyzing mobility for a broad range of facilities. Facilities are classified into two categories of flow: interrupted and uninterrupted.

Interrupted-flow facilities have controlled or uncontrolled access points that can interrupt the traffic flow. These access points include traffic signals, stop signs, and other types of control that stop traffic periodically (or slow it significantly), irrespective of the amount of traffic. Examples of facility types with interrupted flow include urban streets, signalized intersections, two-way stop intersections, and all-way stop intersections.

Uninterrupted-flow facilities have no fixed elements, such as traffic signals, that are external to the traffic stream and might interrupt the traffic flow. Traffic flow conditions result from the interactions among vehicles in the traffic stream and between vehicles and the geometrics and environmental characteristics of the roadway. Examples of facility types with uninterrupted flow include freeways, other multilane highways, and two-lane highways. Freeways operate under the purest form of uninterrupted flow. Not only are there no fixed interruptions to traffic flow, but access is controlled and limited to ramp locations.

Table 2.5 shows different performance measures and flow type for the different types of facilities. Each facility type has a defined method for assessing capacity and level of service . Performance measures reflect the operating conditions of a facility, given a set of roadway, traffic, and control conditions. For example, freeway level of service is based on density (passenger cars/mile/lane), while signalized intersection level of service is based on delay (seconds/vehicle).

Table 2.5 Facility Types, Flow Types, and Performance Measures

Facility Type	Urban Streets (Forest Ave.)	Signalized Intersections	Two-Way Stop Intersections	Freeways (I-295)
Flow Type	Interrupted	Interrupted	Interrupted	Uninterrupted
LOS Performance Measure	Speed (miles/hour)	Delay (seconds /vehicle)	Delay (seconds /vehicle)	Density (passenger cars /mile/lane)

1. Capacity and Level of Service

Capacity is defined as the "maximum sustainable flow rate at which vehicles or persons reasonably can be expected to traverse a point or uniform segment of a lane or roadway during a specific time period under given roadway, geometric, traffic, environmental, and control conditions". Conditions or factors that affect capacity include the number of travel lanes, lane and shoulder width, lateral clearances, alignment, the characteristics of vehicles in the traffic stream, and traffic control and regulations in existence. Capacity is usually measured in vehicles per hour, as is a design hourly volume.

The utilization of capacity is expressed a volume/capacity (v/c) ratio, which is the hourly volume (demand) divided by the hourly capacity. In the real world, the v/c ratio greater than 1.00 will not occur. However, an analysis of a potential traffic demand showing a v/c ratio greater than 1.00 indicates the potential for extensive queuing of vehicles as the available capacity fails to meet the potential demand.

Level of service (LOS) is a qualitative measure describing operational conditions within a traffic stream taking into account a number of variables such as speed and travel time, vehicles maneuverability, traffic interruptions, comfort, and convenience. There are six levels of service defined in the manual ranging from "A" to "F", with "A" representing the best operational condition and "F" representing the worst. Each level of service represents a range of operating conditions and the driver's perception of those conditions.

For freeways like I-95, the HCM 2000 provides the following descriptions for levels of service.

LOS A describes free-flow operations. Free-flow speeds prevail. Vehicles are almost completely unimpeded in their ability to maneuver within the traffic stream. The effects of incidents or point breakdowns are easily absorbed at this level.

LOS B represents reasonably free flow, and free flow speeds are maintained. The ability to maneuver within the traffic stream is only slightly restricted, and the general level of physical and psychological comfort provided to drivers is still high. The effects of minor incidents or point breakdowns are still easily absorbed.

LOS C provides for flow with speeds at or near the free flow speed of the freeway. Freedom to maneuver within the traffic stream is noticeably restricted, and lane changes require more care and vigilance on the part of the driver. Minor incidents may still be absorbed, but the local deterioration in service will be substantial. Queues may be expected to form behind any significant blockage.

LOS D is the level at which speeds begin to decline slightly with increasing flows and density begins to increase somewhat more quickly. Freedom to maneuver within the traffic stream is more noticeably limited, and the driver experiences reduced physical and psychological comfort levels. Even minor incidents can be expected to create queuing, because the traffic stream has little space to absorb disruptions.

LOS E describes operations at capacity. Operations at this level are volatile, because there are virtually no usable gaps in the traffic stream. At capacity, the traffic stream has no ability to dissipate even the most minor disruption, and any incident can be expected to produce a serious breakdown with extensive queuing. Maneuverability within the traffic stream is extremely limited, and the level of physical and psychological comfort afforded the driver is poor.

LOS F describes breakdowns in vehicular flow. Such conditions generally exist within queues forming behind breakdown points. Whenever levels of service F conditions exist, there is the potential for these conditions to extend upstream for significant distances.

Determining an acceptable level of service for highway facilities requires a balance of what is desirable and what is tolerable. While a facility maintained at a highly-desirable LOS A would be too costly to build and maintain for all hours of the day, LOS F for all hours of the day would be intolerable for highway users. Both conditions would be wasteful of time and resources. According to the American Association of State Highway and Transportation Officials (AASHTO), “In heavily developed sections of metropolitan areas, achievements of LOS C may not be practical and the use of LOS D may be appropriate.” As a benchmark, the Bangor I-95 Corridor Study has set LOS D as the benchmark for acceptable operation design hourly volume in the Study Area.

Two broad classes of highway facilities are analyzed for level of service in this study: freeways (I-95) and intersections (at or near interchanges). The freeway facilities include basic freeway segments, weaving segments, and ramp junctions. All of these are evaluated on the basis of traffic density, measured in passenger cars per mile per lane. The level of service ranges for freeways are summarized in Table 2.6. Intersections are either signalized or unsignalized. Both types of intersections are evaluated on the basis of average delay per vehicle. The level of service ranges for intersections are summarized in Table 2.7.

Table 2.6 Freeway Level of Service Ranges

Level of Service	Density Range (pc/mi/ln)		
	Basic Segments	Weaving Segments	Ramp Junctions
A	<=11.0	<=10.0	<=10.0
B	>11.0-18.0	>10.0-20.0	>10.0-20.0
C	>18.0-26.0	>20.0-28.0	>20.0-28.0
D	>26.0-35.0	>28.0-35.0	>28.0-35.0
E	>35.0-45.0	>35.0-43.0	>35.0
F	>45.0	>43.0	Demand>Capacity

Table 2.7 Intersection Level of Service Ranges

Level of Service	Delay Range (sec/veh)	
	Signalized	Unsignalized
A	<=10.0	<=10.0
B	>10.0-20.0	>10.0-15.0
C	>20.0-35.0	>15.0-25.0
D	>35.0-55.0	>25.0-35.0
E	>55.0-80.0	>35.0-50.0
F	>80.0	>50.0

2. Freeway Facilities

The evaluation of existing operating conditions of freeway facilities in the I-95 Corridor are summarized in Tables 2.8 and 2.9. The facilities evaluated consisted of 28 ramp junctions and 30 mainline segments. Table 2.8 shows the mainline segments and ramp junctions operating at each level of service during the AM peak hour. Table 2.9 shows similar information for the PM peak hour. In both tables, the existing levels of service are LOS C or better, with most locations operating at LOS B. This indicates that ample capacity is available in the existing facilities to accommodate existing traffic volumes. Diagrams showing the 2005 I-95 (no-build) AM and PM peak design hourly volumes and the levels of service for individual mainline segments and ramp junctions are located in Appendix 2.

Table 2.8 2005 LOS AM Peak

		Level of Service					
		A	B	C	D	E	F
On/Off Ramps	South Bound	5	10				
	North Bound	2	6	5			
Segments Between On/Off Ramps	South Bound	9	7				
	North Bound	4	6	4			

Table 2.9 2005 LOS PM Peak

		Level of Service					
		A	B	C	D	E	F
On/Off Ramps	South Bound		10	5			
	North Bound	2	8	3			
Segments Between On/Off Ramps	South Bound	1	11	4			
	North Bound	5	8	1			

3. Intersections at Interchanges

Important locations within the Study Area are the at-grade intersections at or near the interchanges. Twelve signalized intersections at or near Exits 182, 184, 185, 186, and 187 were identified for capacity and level of service evaluation.

West of Exit 182 is the 4-way intersection of Odlin Road and Outer Hammond Street (also known as Route 2). The easterly leg of the intersection is the beginning point of I-395.

At Exit 184, three Union Street intersections were identified: the intersections with the northbound ramps and the southbound off-ramp, and the 14th Street intersection, located east of the interchange. Both of the ramp intersections have been classified as high crash locations, as shown in Figure 2.14.

At Exit 185, three Broadway intersections were identified: the intersections with the northbound and southbound ramps, and the Falvey Street intersection, located west of the interchange.

At Exit 186, two Stillwater Avenue intersections were identified: the intersection with the Exit 186 ramps and the Bangor Mall intersection north of the interchange.

At Exit 187, three Hogan Road intersections were identified: the intersections with the northbound and southbound ramps and the intersection with Bangor Mall Drive and Springer Drive. Both of the ramp intersections have been classified as high crash locations, as shown in Figure 2.16.

Table 2.10 shows the existing PM peak-hour level of service, overall delay, and volume/capacity ratio for each of the 12 signalized intersections. Overall operating conditions are adequate with acceptable levels of service and volumes lower than the available capacities. The lowest level of service (LOS D) and greatest delays are found at the intersection of Hogan Road and Bangor Mall Boulevard, where field observations and capacity analysis show that traffic volumes on some approaches are not as evenly distributed on the available lanes as needed for efficient operation.

Table 2.10 Existing Operating Conditions at Intersections

Interchange Location and Intersection		Level of Service	Delay	V/C Ratio
			(sec/veh)	
Exit 182	Outer Hammond and Odlin Rd	B	17.4	0.63
Exit 184	I-95 SB and Union	B	14.9	0.56
	I-95 NB and Union	B	18.5	0.64
	14th Street and Union	A/B	9.9	0.55
Exit 185	Falvey Street and Broadway	B	13.8	0.44
	I-95 SB and Broadway	B	16.6	0.68
	I-95 NB and Broadway	C	22.3	0.73
Exit 186	I-95 and Stillwater Ave	C	25.9	0.76
	Bangor Mall and Stillwater Ave	B	14.1	0.64
Exit 187	Bangor Mall and Hogan Road	D	41.4	0.78
	I-95 SB and Hogan Road	B	17.3	0.73
	I-95 NB and Hogan Road	C/B	20.7	0.71

E. Other Transportation Facilities and Services

I-95 through Bangor is the core of a transportation network of facilities and services that serves the area around I-95. The following describes some of the other key facilities and services in the Corridor.

1. Highways

Although I-95 is the most important highway in the Greater Bangor Area, several important highways connect with I-95 in the Study Area. Many of these highways not only link I-95 to urban centers and rural communities in the region, but the non-Interstate urban highways also serve as components of the local bicycle and pedestrian network.

I-395

I-395 is an east-west Interstate route that begins at I-95 Exit 182 and extends east across the Penobscot River through Brewer. I-395 serves as a major connector between Bangor and Brewer and points further east.

Route 2

U.S. Route 2 is an east-west 2-lane highway that connects Bangor with points to the west, including Newport and Skowhegan, and with points to the northeast, including Orono, Old Town, Lincoln, and Houlton. Between Newport and Houlton, Route 2 and I-95 are parallel routes. Route 2 crosses I-95 at Exit 183 (Hammond Street) and also has I-95 access at Exit 182.

Route 222

State Route 222 (Union Street) at Exit 184 connects I-95 with downtown Bangor, Bangor International Airport, and outlying communities to the northwest.

Route 15

State Route 15 (Broadway) at Exit 185 connects I-95 with points to the northwest, including Dover-Foxcroft and Greenville. Broadway also connects I-95 to downtown Bangor, southeast of Exit 185. The Route 15 designation follows along I-95 and I-395 from Exit 185 in Bangor to I-395 Exit 4 in Brewer, where it departs I-395 and proceeds southerly to Bucksport and Deer Isle.

Stillwater Avenue and Hogan Road

Both Stillwater Avenue and Hogan Road, through Exits 186 and 187, connect I-95 to the commercial district anchored by the Bangor Mall. Stillwater Avenue also serves as a route to Orono, parallel to I-95. Hogan Road also serves as a connecting road to Route 2 north of downtown Bangor.

2. Railroads

The Greater Bangor Area is served by two regional freight railroads that carry freight that would otherwise be transported on I-95 or parallel highway routes.

Pan Am Railways

Pan Am Railways, formerly the Guilford Transportation System, is a freight railroad that parallels I-95 and serves most of the same communities, connecting them to the national railroad system. Pan Am crosses beneath I-95 immediately south of Exit 182.

Montreal, Maine & Atlantic Railroad

The Montreal, Maine & Atlantic is a freight railroad that parallels I-95 between Bangor and Houlton, and extends south to Penobscot Bay at Searsport. The Montreal, Maine & Atlantic connects to Pan Am west of Bangor and to Canadian railroads in northern Maine and Quebec.

3. Transit and Ridesharing Services and Facilities

Services and facilities that support public transit use and ridesharing are important elements of the transportation system that improve the productivity of the highway facilities, promote energy conservation, and provide transportation alternatives to single-occupant automobiles.

Local Bus Services

The BAT (Bangor Area Transportation) fixed-route bus system provides local scheduled transit service to Bangor and the local communities of Brewer, Hampden, Veazie, Orono, and Old Town. The BAT has an annual ridership over 800,000.

GO Maine

GO Maine is a statewide service that promotes ridesharing by organizing car pools and van pools and by disseminating information to the public on available transit options.

Park & Ride Lots

The Bangor Area has two MaineDOT-designated park & ride lots, both near the I-95 Corridor. At the corner of Odlin Road and Route 2 (Outer Hammond Street), near Exit 182, is an established 50-space park & ride lot. At a Wal-Mart site on the corner of Hogan Road and Stillwater Avenue, near Exit 187, is a 40-space park & ride lot opened in 2010.

F. Environmental Overview

The I-95 Corridor in Bangor passes through primarily commercial and urban residential areas. Table 1 summarizes the major environmental features east and west of the I-95 right-of-way for the 7.5 mile long corridor.

Physical and Biological Environment

I-95 crosses the Kenduskeag Stream, located in a gorge between Exits 184 and 185. Most of the land around the I-95 Corridor in Bangor is level or rolling terrain that has been developed. Land types at the north and south ends of the Corridor are primarily forested rural areas.

Land Use, Cultural, Social and Economic Environment

A mix of urban land uses can be found along the I-95 Bangor Corridor. From exit 187 to exit 186 the land uses are primarily commercial. From exit 185 to exit 183 the land uses are a mix of both commercial and urban residential. A cemetery is located on both the east and west sides on I-95 between Exit 184 and the Kenduskeag Stream. From exit 183 south, land is primarily commercial or light industrial.

There are a number of resources of interest to the cultural, social and economic environment located along the I-95 Bangor Corridor. The Bangor International Airpor and the Bangor Municipal Golf Course abut the I-95 Corridor on the north side of Exit 182. The largest retail district in eastern Maine, anchored by the Bangor Mall, is located along I-95 north of Exit 186 in the Exit 187 (Hogan Road) area.

Atmospheric Environment

The atmospheric environment of the I-95 Bangor Corridor has two major components: air and noise.

Under the rules of the Clean Air Act and Clean Air Act Amendments of 1990, the Bangor area has been designated as an attainment area. The Bangor area has been shown to meet current air quality standards.

The most notable noise issue along the I-95 Bangor Corridor was located south of exit 185 along the east side of the northbound lane. A study of this area was performed in the early 1990s, leading to the construction of a sound barrier. A 2010 study of the noise conditions along the westerly side of the Exit 183 area found that a noise barrier at that location would be economically infeasible.

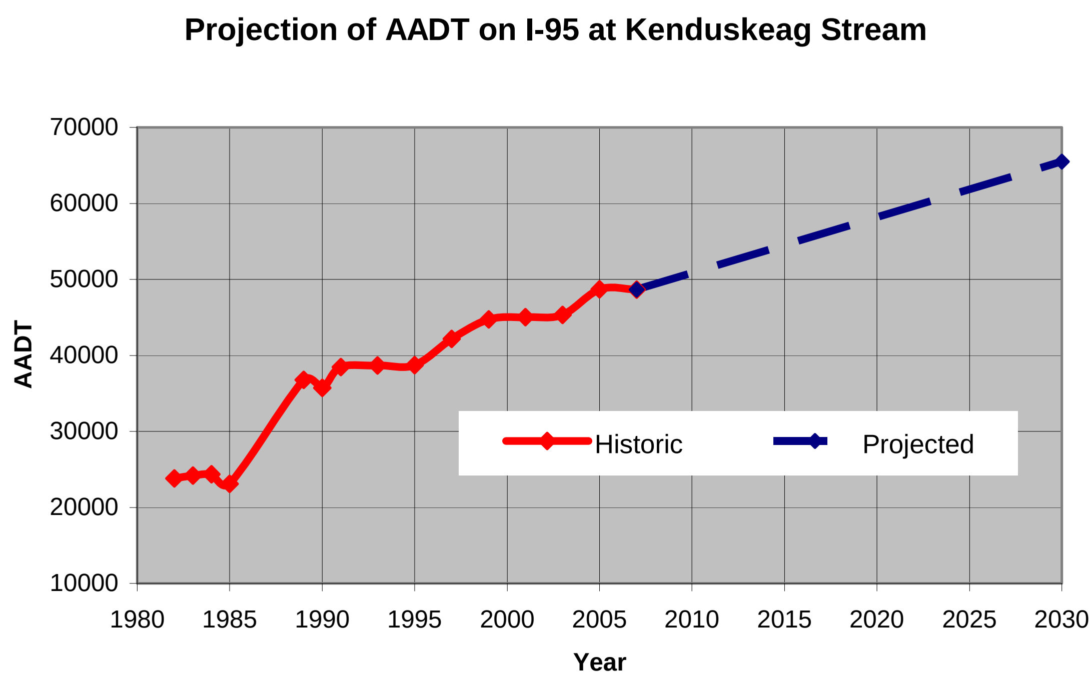
Table 2.11 Environmental Resources and Constraints

Resources/Constraints - West	I-95 Corridor	East - Resources/Constraints
	Bangor/Veazie T/L	
rural forested		rural forested / residential
commercial		commercial
Hogan Road	**Exit 187**	Hogan Road
commercial		commercial
Bangor Mall		
commercial		commercial
Stillwater Avenue	**Exit 186**	
residential		residential
rural		
commercial / residential		residential
Broadway	**Exit 185**	Broadway
residential		sound barrier / residential
Kenduskeag Stream		Kenduskeag Stream
residential / cemetery		cemetery / residential
Union/Ohio	**Exit 184**	Union/Ohio
residential		residential
commercial		residential
Hammond Street	**Exit 183**	Hammond Street
commercial / residential		residential
Bangor International Airport		
commercial		Bangor Municipal Golf Course
Outer Hammond Street	**Exit 182**	I-395
industrial / commercial		industrial
industrial		forested rural
	Bangor/Hermon T/L	

III Future Conditions

To evaluate the impact of future travel on the Bangor I-95 Corridor, future hourly traffic volume conditions were estimated by projecting historical traffic data to the year 2030. Historic traffic growth trend between 1989 and 2007 has been relatively consistent, after the extension of I-395 from Bangor through Brewer in 1986. Projection of this growth trend suggests a linear growth in traffic at an annual rate of 1.5% from the 2007 base year. Extended to year 2030, the traffic volume on I-95 would increase by 34.5% over the 23-year period.

Figure 3.1 Bangor I-95 Traffic Projection



A. Mobility and Operating Conditions

For the purpose of analysis, the 2030 No-Build assumptions included the following:

- Overall growth of traffic for the Bangor I-95 Corridor would be 34.5% between 2007 and 2030.
- Hourly volumes on I-95 mainline segments and ramps would increase by the same percentage.

The baseline or No-Build strategy would maintain the existing corridor infrastructure, but would not make any improvements on I-95 or any parallel transportation route that could affect transportation operations on I-95. The No-Build strategy was used as a base for comparison with other strategies and actions.

1. Freeway Facilities

The effects of projected 2030 traffic volumes on the operating conditions of freeway facilities in the I-95 Corridor were evaluated using the same analysis procedure described under Section II C, Existing Conditions. Tables 3.1 and 3.2 summarize 2030 no-build levels of service (LOS) in the AM and PM peak hours. Diagrams showing the 2030 I-95 (no-build) AM and PM peak design hourly volumes and levels of service for mainline segments and ramp junctions are located in Appendix 3.

Table 3.1 2030 No-Build LOS AM Peak

		Level of Service					
		A	B	C	D	E	F
On/Off Ramps	South Bound		10	5			
	North Bound		3	3	7		
Segments Between On/Off Ramps	South Bound	2	9	5			
	North Bound		5	5	4		

As shown in Table 3.1, most ramp junctions and freeway segments would operate at LOS B or C in the AM peak hour, but nearly twenty percent (11 of 58) of the ramps and segments would operate at LOS D, all of them in the northbound direction. In 2005, there were no segments with a LOS of D during the AM Peak.

Table 3.2 2030 No-Build LOS PM Peak

		Level of Service					
		A	B	C	D	E	F
On/Off Ramps	South Bound		1	10	4		
	North Bound		4	7	2		
Segments Between On/Off Ramps	South Bound		2	9	5		
	North Bound	1	4	7	2		

Table 3.2 also shows that, in the PM peak hour, most ramp junctions and freeway segments would operate at LOS B or C, but nearly twenty-five percent (13 of 58) of the ramps and segments would operate at LOS D. As with the AM peak, there were no segments with a LOS D during the PM peak in 2005.

The findings that projected 2030 operating conditions show no mainline segments or ramp junctions operating at LOS E or F suggest that the current number of through lanes, two in each direction, will be sufficient to meet the capacity needs of I-95 in Bangor at least through 2030 and possibly well beyond. However, the safety issues identified on the mainline and at ramp junctions in the Existing Conditions section need to be addressed.

2. Intersections at Interchanges

Below in Table 3.3 is a summary of future overall PM peak-hour operating conditions of the intersections at interchanges. Although all of the intersections show an increase in delay and the v/c ratio, when compared with the existing conditions summarized in Table 2-10, most intersections would continue to operate at an acceptable level of service. The exceptions would be the intersection of Outer Hammond Street and Odlin Road, near Exit 182, and the intersection of Hogan Road with Bangor Mall Boulevard. Both intersections would operate below LOS D. The Hogan Road intersections showed the most significant increase in delay of the intersections modeled.

Table 3.3 Future Overall Operating Conditions at Intersections

Interchange Location and Intersection		Level of Service	Delay	V/C Ratio
			(sec/veh)	
Exit 182	Outer Hammond and Odlin Rd	E/D	55.3	0.77
Exit 184	I-95 SB and Union	B	14.5	0.67
	I-95 NB and Union	B	16.5	0.75
	14th Street and Union	B	11.5	0.64
Exit 185	Falvey Street and Broadway	B	15.5	0.49
	I-95 SB and Broadway	C	26.8	0.79
	I-95 NB and Broadway	C	22.5	0.78
Exit 186	I-95 and Stillwater Ave	C	32.9	0.85
	Bangor Mall and Stillwater Ave	C	24.8	0.73
Exit 187	Bangor Mall and Hogan Road	F	101.5	0.86
	I-95 SB and Hogan Road	C	22.1	0.78
	I-95 NB and Hogan Road	C	28.7	0.88

While most intersections may perform well overall, several intersections may have operating deficiencies for one or more intersection movements. Below are descriptions of the operational issues identified in the future conditions analysis.

Exit 182: Outer Hammond Street at Odlin Road

In addition to significant overall delays, queuing at the eastbound (Outer Hammond) left turn and the southbound (Odlin) left turn exceeded the storage capacity of the eastbound and southbound left-turn bays.

Exit 185: Broadway

At the intersection of Broadway and the southbound interchange ramps, the future conditions analysis showed excessive queuing on the southbound off-ramp, with backups extending beyond the existing length of the right-turn pocket.

Exit 186: Stillwater Avenue

Substantial increases in delay were indicated in the future conditions analysis, with significant queuing on the Stillwater Avenue approaches of the Exit 186 intersection.

Exit 187: Hogan Road

The future conditions analysis of the Hogan Road intersections shows two of the three intersections having the highest volume/capacity ratios in the study area. The Hogan Road intersections with the northbound ramps and Bangor Mall Boulevard both would have v/c ratios in the 0.85 to 0.90 range, higher than any other intersections in the Study Area.

The analysis also shows that the intersection of Hogan Road with Bangor Mall Boulevard would operate at LOS F, the worst level of service of any intersection in the Study Area. Significant queues would appear on the Bangor Mall Boulevard , Springer Drive, and eastbound Hogan Road approaches. High traffic volumes and uneven utilization of available lanes at the intersection would contribute to the delays and poor level of service. Uneven utilization of the double left-turn lanes from Springer Drive to Hogan Road is partially responsible for the long queues on Springer. Motorists from Springer intending to make the right turn onto the southbound I-95 on-ramp tend to favor the right left-turn lane. Delays at the Bangor Mall Boulevard intersection also result from significant eastbound delays at the intersection of Hogan Rd and I-95 southbound ramp, with the right turn on to the I-95 southbound on-ramp backing up to the other intersection.

B. External Factors and Trends

The analysis of 2030 traffic projections in the Bangor I-95 Corridor provides a reasonable estimate of future traffic conditions based on traffic growth trends of the last 20 years. However, some external factors and trends, as discussed below, could have a substantial impact on future traffic conditions.

Interstate Truck Weight Limits

The State of Maine, with the approvals of the United States Congress and the Maine State Legislature, now allows 100,000-lb tractor-trailers on the full Interstate system in Maine on a trial basis. Before December 2009, these vehicles in Maine were restricted to the Maine Turnpike and non-Interstate highways, while the non-toll Interstate highways were limited to 80,000-lb vehicles. Since December 2009, evidence has shown that the use of non-toll Interstate highways by 100,000-lb vehicles has increased while use of non-Interstate highways has decreased. In the Bangor area, a permanent increase in the weight limit would place a greater truck demand on I-95 and I-395, but it would reduce the truck traffic impact on most non-Interstate arterials.

Aging Population

The population of the United States is aging. As the wave of “baby boomers”, born between 1945 and 1965, enter their 60’s, 70’s, and 80’s, the driving habits of a large segment of our population will change. Older people drive less and rely on public transportation more. This trend will tend to slow the growth of automobile travel.

New Technology

Changes in technology continue in the transportation field. Automobiles are increasingly equipped with GPS and sensor technology that allows greater automation in the navigation and control of the vehicle. Automatic sensors and communication devices in highways are providing better information to drivers about conditions ahead. The combination of more intelligent vehicles and highways may lead to greater automation of the driving task and allow the closer spacing of vehicles, more capacity, and greater safety on controlled access highways.

Energy Costs

Recent experience in 2008 has shown that increases in the price of gasoline can reduce automobile travel, at least in the short term. The future price of motor fuels is difficult to predict, but rising demand for fuel in rapidly growing economies in China, India, and other parts of the developing world will put increasing pressure on petroleum supplies and upward pressure on energy prices. These pressures will push transportation in the United States more toward alternative fuels, fuel-efficient vehicles, and other modes of transportation.

Transportation Funding

Transportation funding by conventional motor fuel taxes is unable to keep up with financial demands of maintaining and improving the highway system. The energy trends of higher fuel prices and less dependence on gasoline and diesel fuels, coupled with rising highway and bridge construction costs, are creating a widening gap between revenues and needed expenditures. This trend will push policy makers to find new means of collecting revenue for transportation.

IV Alternatives

To address the safety and mobility challenges of the I-95 Corridor, a broad range of alternatives were considered. The range of reasonable alternatives is guided by the extent, magnitude, and types of challenges that exist in the Corridor now of may unfold in the future. Physically, many of the original bridges in the corridor are in need of rehabilitation or replacement. Functionally, the biggest challenge is the safety of the ramp junctions that must accommodate much higher traffic volumes than the volumes for which they were originally designed. The range of alternatives identified for analysis in this study is intended to address the functional challenges of this Corridor in a way that is consistent with the actions necessary to meet the physical challenges.

A. Strategies, Actions, and Options

To address the existing and future needs of the I-95 Corridor, a broad range of strategies was identified. Each strategy represents a different approach toward solving the functional problems in the I-95 Corridor. Some strategies are oriented toward specific locations while others are Corridor-wide. Most are directed at geometric improvements to the highway corridor while others are directed at traveler behavior.

Within each strategy, there may be one or more potential actions. The potential actions are specific projects or programs to address problems in the I-95 Corridor. Most of these actions are location-specific. Table 4.1 shows the strategies and types of actions considered for the I-95 Corridor Study. For some actions, there may be multiple options. These are variations of the action that are aimed at achieving the same purpose.

Table 4.1 Strategies and Actions Considered

Strategies	Characteristics	Actions
Auxiliary Lanes	• Relatively low cost • Targeted toward specific interchange ramps or short highway segments • For improved efficiency and safety at on-ramps and off-ramps	• Increase acceleration and or deceleration lengths at interchange ramp junctions
Intelligent Transportation Systems (ITS)	• Relatively low cost • Applies corridor-wide or to portion of the corridor • For improved efficiency of existing facilities	• Establish traffic monitoring facilities • Install variable message signing • Establish service patrol
Transportation Demand Management (TDM)	• For relief of travel demand in the corridor • Involves change in driver behavior	• Establish park & ride facility • Create carpool incentives • Improve local bus service
Commuter Transit	• For relief of travel demand in the corridor • Involves alternative transportation facilities and services	• Establish commuter bus service to Bangor
Interchange Improvements	• Major improvements at specific interchanges	• Realign ramp • Build new ramp • Improve ramp intersections • Build new interchange
New Highway Capacity	• For added vehicular capacity • Involves construction of additional lanes for use by general traffic	• Add through lanes along I-95 mainline

B. Strategy Assessment

Before identifying specific actions, each of the considered strategies was assessed for its relative cost, effectiveness, and practicability in addressing corridor problems.

Auxiliary Lanes

Many of the identified problems in the Corridor relate to on-ramp and off-ramp junctions with the I-95 mainline. Some of these ramp junctions are high crash locations. As evidenced by Table 4.2, many have acceleration and deceleration lanes that are shorter than those in AASHTO guidelines. Actions to increase the lengths of these acceleration and deceleration are relatively low in cost, require no additional right-of-way. Auxiliary lanes have been advanced as a strategy for analysis in this Study.

Intelligent Transportation Systems (ITS)

ITS continues to grow as an established strategy to realize as much operational potential as possible on existing highways. ITS helps transportation agencies inform motorists of current roadway conditions and minimize the duration and impact of traffic incidents and other traffic events. Records show that the I-95 Corridor in Bangor has more than 1400 traffic incidents per year. ITS, which includes elements such as traffic monitoring, motorist information, service patrols, and a centralized control center, could be a very cost-effective way of managing traffic congestion and maximizing public safety in the I-95 Corridor. ITS is a strategy advanced further for analysis in this Study.

Transportation Demand Management (TDM)

The TDM strategy aims at reducing vehicular traffic by encouraging more use of ridesharing and mass transportation. The Bangor area has an established route system of local bus service for shorter trips, but facilities and services for carpooling and van pooling have been relatively undeveloped. Although the expansion of ridesharing may have a limited impact on reducing traffic in the I-95 Corridor, it can, at a relatively low cost, make a contribution that extends beyond I-95 Study Area. Ridesharing is also the first step toward establishing van pools and commuter transit services. Bangor and the surrounding region may be an area where there is potential for development of more ridesharing, so this aspect of TDM should be analyzed further.

Interchange Improvements

More costly than, but potentially more effective than, auxiliary lane improvements, interchange improvements involve the construction of ramps, sometimes on expanded right-of-way. Interchange intersection improvements and relocated or widened ramps may address high crash locations and other operational problems. New ramps and new interchanges can improve I-95 access and provide traffic relief on arterial streets, where congestion is more likely to be an issue, now and in the future. Interchange improvement is a strategy to be analyzed further.

New Highway Capacity

New highway capacity can be one of the most costly strategies, but it can be most effective where traffic demand exceeds highway capacity. New capacity in existing right-of-way generally has less environmental impact than new capacity on new right-of-way. In the Bangor I-95 Corridor, the existing and future conditions analyses indicate that the highway capacity of the I-95 mainline will not be challenged by the growth of traffic in the next 20 years. New highway capacity is not to be pursued further as functional improvement strategy in this Study.

It is important to note, however, that the need for additional capacity on the I-95 mainline in Bangor may be a possibility during the life of any new replacement bridges built over I-95. It has been, and remains, MaineDOT policy to build replacement bridges over I-95 with sufficient length between abutments to accommodate three through lanes in each direction underneath. The policy provides a future ability to expand capacity, if necessary, with a minimum of costly remedial work on bridges over I-95.

C. Candidate Actions

From the strategies selected for further analysis, candidate actions were identified. These candidate actions would be evaluated for effectiveness, cost, and potential implementation issues. Table 4.2 is a list of candidate actions for analysis. Descriptions of the candidate actions follow.

Table 4.2 Candidate Actions for Analysis

Strategies	Actions	Locations
Auxiliary Lanes	Increase acceleration and or deceleration lengths at interchange ramp junctions	NB 182A off-ramp NB 182B on-ramp NB 183 on-ramp NB 184 off-ramp NB 184 on-ramp NB 185 off-ramp NB 185 on-ramp NB 187 on-ramp SB 187 on-ramp SB 186 on-ramp SB 185 off-ramp SB 185 on-ramp SB 184 on-ramp SB 183 on-ramp (northern) SB 182A on-ramp
Intelligent Transportation Systems (ITS)	Establish traffic monitoring facilities	I-95 (and I-395)
	Install variable message signing	I-95 (and I-395)
	Establish service patrol	I-95 (and I-395)
Transportation Demand Management (TDM)	Establish park & ride facility	Exit 185 area
	Increase carpooling and vanpooling	Greater Bangor area
Interchange Improvements	Improve intersections at/near interchanges	Exit 182, Odlin @ Outer Hammond Exit 185, Broadway @ SB ramps Exit 186, Stillwater @ ramps Exit 187, Hogan @ SB ramps
	Construct flyover ramp	Exit 182, WB to SB
	Construct median lanes	Exit 182, NB and SB
	Realign northbound on-ramp	Exit 184
	Construct northbound on-ramp	Exit 186
	Construct new interchange	north of Exit 187
Other	Install median barrier	Between Mile 183 and Mile 186

1. Auxiliary Lanes

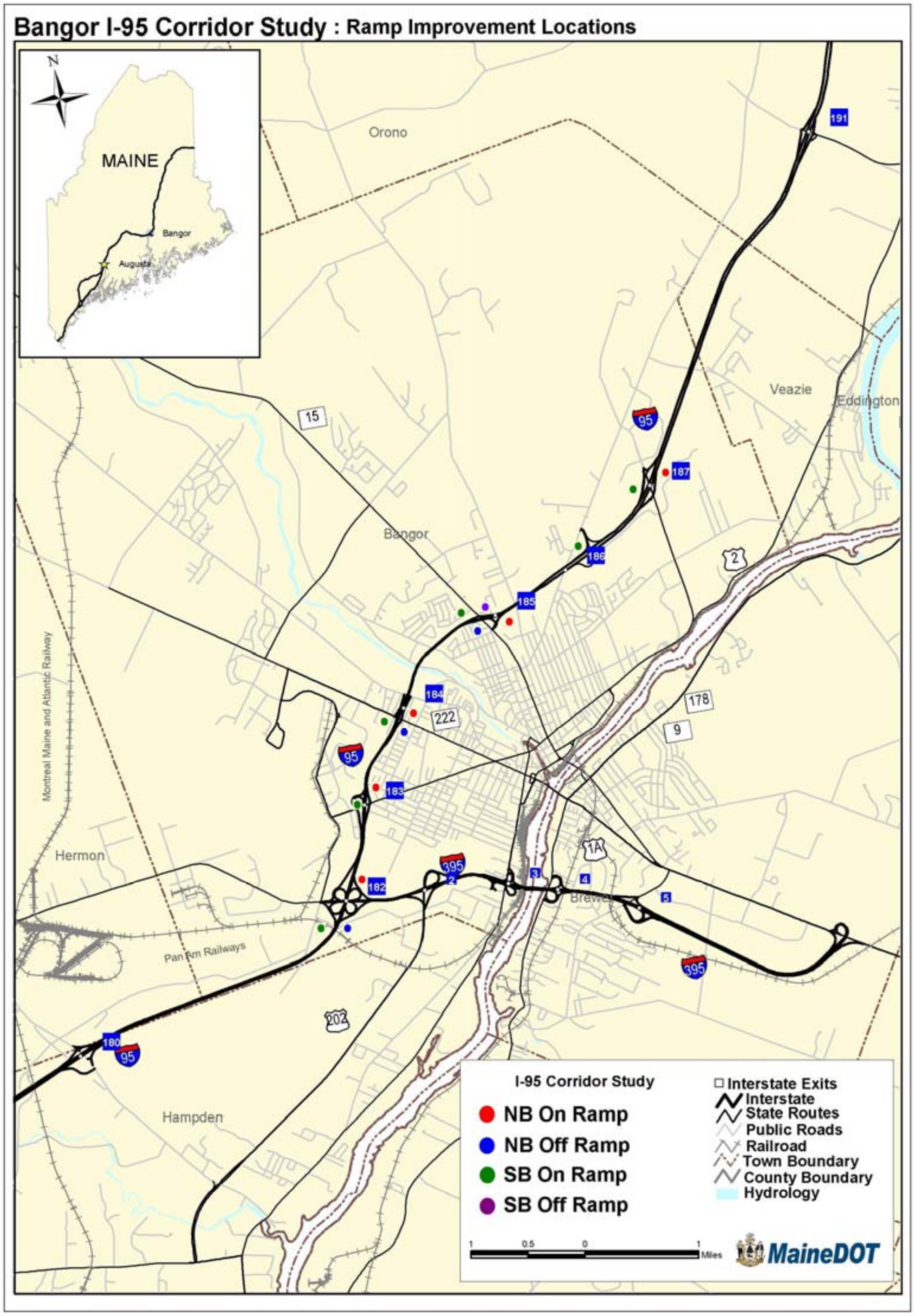
This strategy includes relatively low-cost actions that improve safety and operation of the highway. For I-95 through Bangor, this includes the construction of additional length to the acceleration and decelerations parallel to the two mainline lanes of I-95 at the ramp junctions or along short segments of I-95 between interchanges. These added lengths for acceleration and deceleration allow users of the on-ramps and off-ramps to change their speed with less interference with the flow of mainline traffic. This smoother flow of traffic would reduce crashes and congestion on I-95. Candidates for these improvements were drawn from the ramp locations where the acceleration or deceleration lanes are shorter than the length suggested by guidelines of the American Association of State Highway and Transportation Officials (AASHTO). As listed in Table 4.2, extended acceleration lanes have been considered at five northbound on-ramps and six southbound on-ramps, and extended deceleration lanes have been considered at three northbound off-ramps and one southbound off-ramp.

Table 4.2 Potential Improvements to Accel/Decel Lanes at On/Off Ramps

I-95 Direction	Interchange Exit #	Interchange Arterial	On/Off Ramp	Accel/Decel Length (feet) Existing	Improved
Northbound	182A	I-395 EB	Off	250	340
	182B	I-395 WB	On	450	600
	183	Hammond	On	250	600
	184	Union	Off	150	340
			On	200	600
	185	Broadway	Off	375	440
			On	150	600
	187	Hogan	On	325	600
Southbound	187	Hogan	On	300	600
	186	Stillwater	On	360	600
	185	Broadway	Off	260	340
			On	340	600
	184	Ohio	On	315	600
	183B	Hammond	On	465	900
	182A	I-395 EB	On	500	600

The suggested improved acceleration/deceleration lengths are based on AASHTO guidelines for transitions between a 65 mph mainline design speed and a 40 mph ramp design speed. (I-95 was originally posted for 60 mph through Bangor.) The improved acceleration and deceleration lanes would be parallel to the I-95 mainline through lanes. For on-ramps, the suggested acceleration length would be 600 feet, and for the off-ramps, the suggested deceleration length would be 340 feet. Exceptions would be the northbound Exit 185 off-ramp and the southbound Exit 183B on-ramp, where the loop ramps, with their lower speeds, require longer auxiliary lanes.

Figure 4.1 Potential Accel/Decel Improvement Locations



2. Intelligent Transportation Systems

Intelligent Transportation Systems (ITS) has been defined as the application of advanced sensor, computer, electronics, and communications technologies and management strategies – in an integrated manner – to increase the safety and efficiency of the surface transportation system. In other words, ITS is using the best tools available to help our existing transportation facilities work better.

For I-95 in Bangor, ITS may mean integrating the available ITS assets, such as variable message signs, with ITS improvements into a statewide or regional system, which in some metropolitan areas is known as a Freeway Management System. Before such a system can be established, MaineDOT and the other agencies involved will need a plan for how ITS will be developed and used in Maine. As this plan is being developed, some ITS assets are already in use and new opportunities for use of ITS in the Bangor area are emerging. Figure 4.2 shows existing ITS assets and potential ITS enhancements that could benefit I-95 in the Bangor area. These assets and potential enhancements include the following elements of ITS.

Traffic Monitoring

Traffic monitoring provides the real-time information needed to assess the current performance of the highways in the system. Full time detection of traffic volumes and speeds provides the information needed to detect incidents and other problems on the highway. It also provides traffic data that can be used for highway planning purposes. Traffic monitoring is most effective when sensors are located on each highway segment between ramps and on the ramps themselves. In addition to sensors for traffic volumes and speeds, video monitoring can be used to obtain live images of operations at key locations on the highway.

In the Bangor area, the only permanent traffic monitoring equipment on the Interstate System is on I-395 in Brewer. The need for improved traffic monitoring on I-95 in Bangor can best be met by instrumentation of the portion between Exit 182 and Exit 187. This portion of I-95, along with the connecting I-395 link to Brewer, has the highest volumes and the greatest opportunities for effective traffic management.

Other forms of monitoring, involving the collection of roadway or bridge temperature and surface condition, such as remote surface state sensors, could provide additional information to agencies that will help keep motorists safe.

Motorist Information

Means of transmitting real-time information to motorists are necessary to ensure that motorists have data needed to make timely transportation decisions. Two common ways of communicating current information to motorists is through variable message signing and highway advisory radio.

MaineDOT has not used highway advisory radio in the Bangor area, but it has installed and used permanent variable message signs on the three Interstate highway approaches to Bangor. Improvements in traffic monitoring can provide better information on traffic and roadway conditions that will make motorist information tools more useful and more effective.

Service Patrols

Service patrols can be an effective tool for managing highway incidents. This service, which involves vehicles and personnel dedicated to patrolling a highway to resolve incidents quickly and effectively, can help identify incidents and be the responder for those incidents that do not require emergency response. Such incidents would include stalled vehicles, vehicles with flat tires, or debris in the roadway. Service patrols can shorten the duration of incidents, allow emergency responders to be more available for emergency tasks, and provide much-appreciated help to motorists in trouble. As part of a Freeway Management System, service patrols can identify and verify traffic incidents and report them to a control center for further actions, as appropriate.

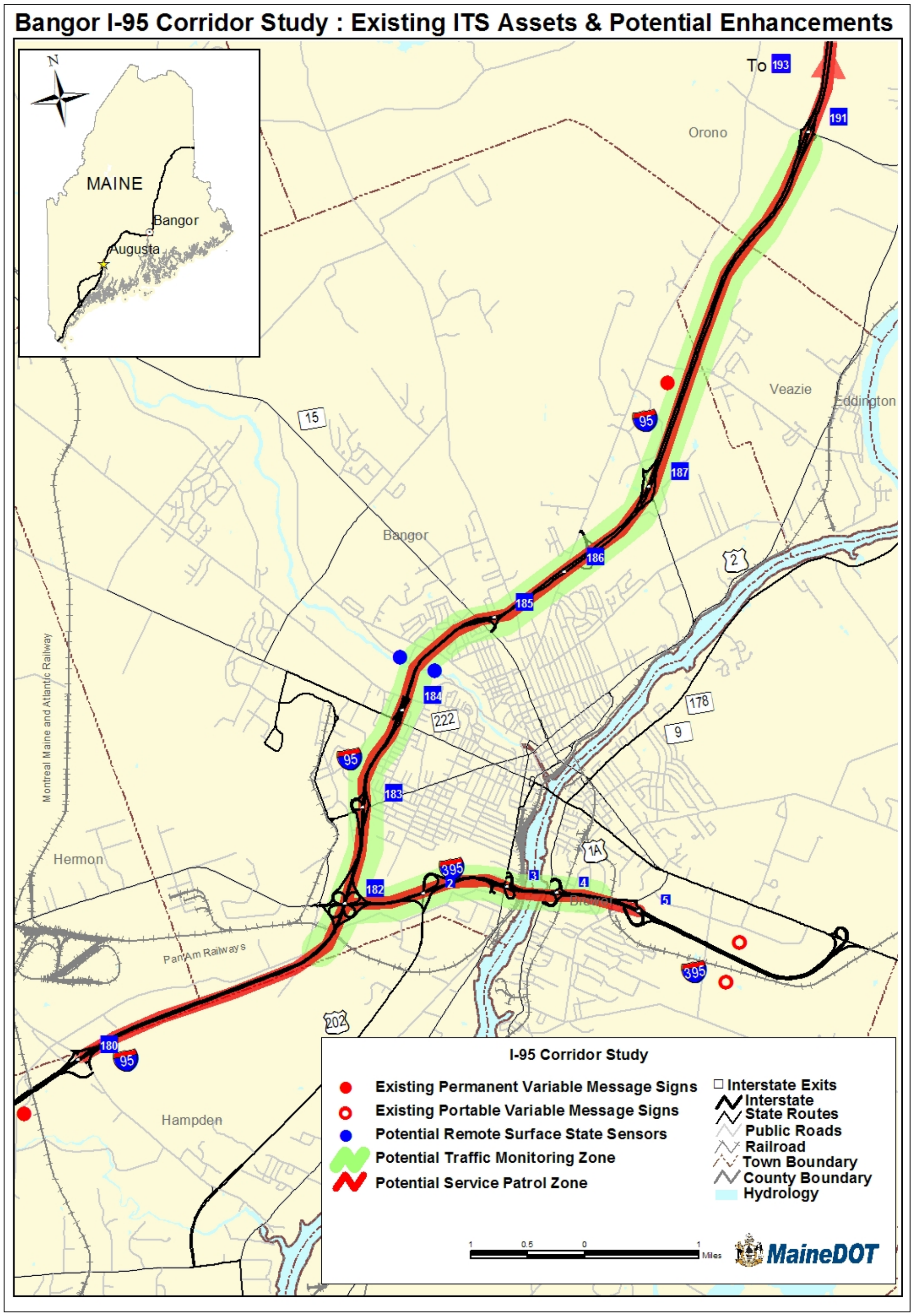
Service patrols have been instituted on the Maine Turnpike, but they have not yet been used on MaineDOT’s Interstate highways. With high traffic volumes and thousands of incidents per year, the Interstate mileage in Bangor is a potential candidate for such patrols. The Interstate mileage covered by a service patrol in the Bangor area could extend beyond the Study Area boundaries to I-95 Exit 180 in Hermon, I-95 Exit 193 in Orono, and I-395 Exit 5 in Brewer to provide more complete coverage of the higher-volume Interstate mileage.

Control Center

To tie the various elements of ITS together, a control center is necessary to process the information coming from the highway, dispatch information to responders, and communicate conditions to motorists. The control center must operate through lines of communications and protocols established jointly among the agencies that will make the management system work.

In the I-95 Corridor in the Bangor area, the Maine Department of Transportation, the Maine State Police, and local and regional government entities have a role in a Freeway Management System. All of these agencies currently have control functions for dealing with situations on all or part of the Interstate highway network, but these functions are not fully integrated. These agencies would plan, design, and establish a control center that manages the network in a comprehensive manner. Decisions will need to be made regarding the scope of the control center and where it would be located.

Figure 4.2 Existing ITS and Potential Improvements



3. Transportation Demand Management

Transportation Demand Management (TDM) is the use of low-cost actions to modify travel behavior by encouraging people to share rides, telecommute, use transit, or change their travel route. Effective use of TDM can help travelers save on transportation costs, have a reduced impact on the environment, and prolong the life of existing highway capacity. An improved network of park & ride facilities is a way to enhance TDM in the Bangor area.

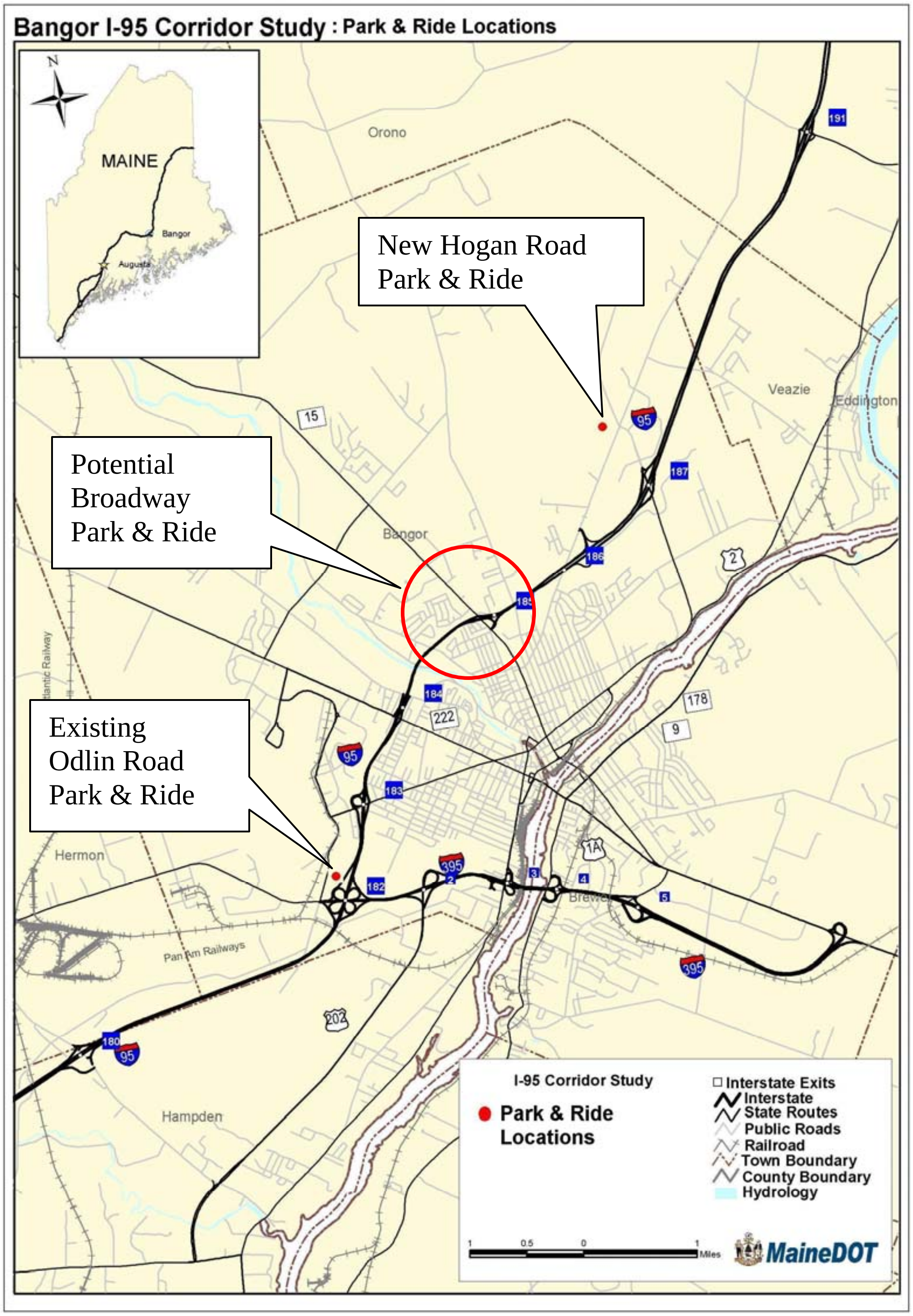
Park & Ride Lots

Park & Ride lots are areas where travelers can meet and carpool to shared destinations. The benefits of carpooling are less congestion and reduced fuel consumption. Currently, there are two park & ride lots along the Bangor I-95 Corridor. One park & ride lot is located off Exit 182 on Odlin Road and the other is located west of Exit 187 on Hogan Road. Both are located near I-95 and serve travelers from the Bangor area using I-95 to reach destinations outside the Bangor area.

Other potential park & ride lots could be located in Bangor to serve travelers using Route 15 toward Dover-Foxcroft and beyond and in Brewer to serve travelers using Route 1A toward Ellsworth and beyond. Both could be located at or near Interstate highways: I-95 Exit 185 in Bangor and I-395 in Brewer, respectively.

A park & ride lot at Exit 185 could serve a variety of travelers in the I-95 Study Area. Those who are Bangor residents east of the Kenduskeag Stream and those from communities on Route 15 North could use the facility as the meeting point for travel north or south on I-95. Currently, neither group has convenient park & ride access prior to entering I-95. Bangor residents also could use the facility as a meeting point for travel north on Route 15. Exit 185 is adjacent to the Broadway commercial district and is also served by two bus routes of the Bangor Area Transit system, providing intermodal passenger potential. Figure 4.3 shows the potential park & ride location at Exit 185 and its relationship to existing park & ride lots.

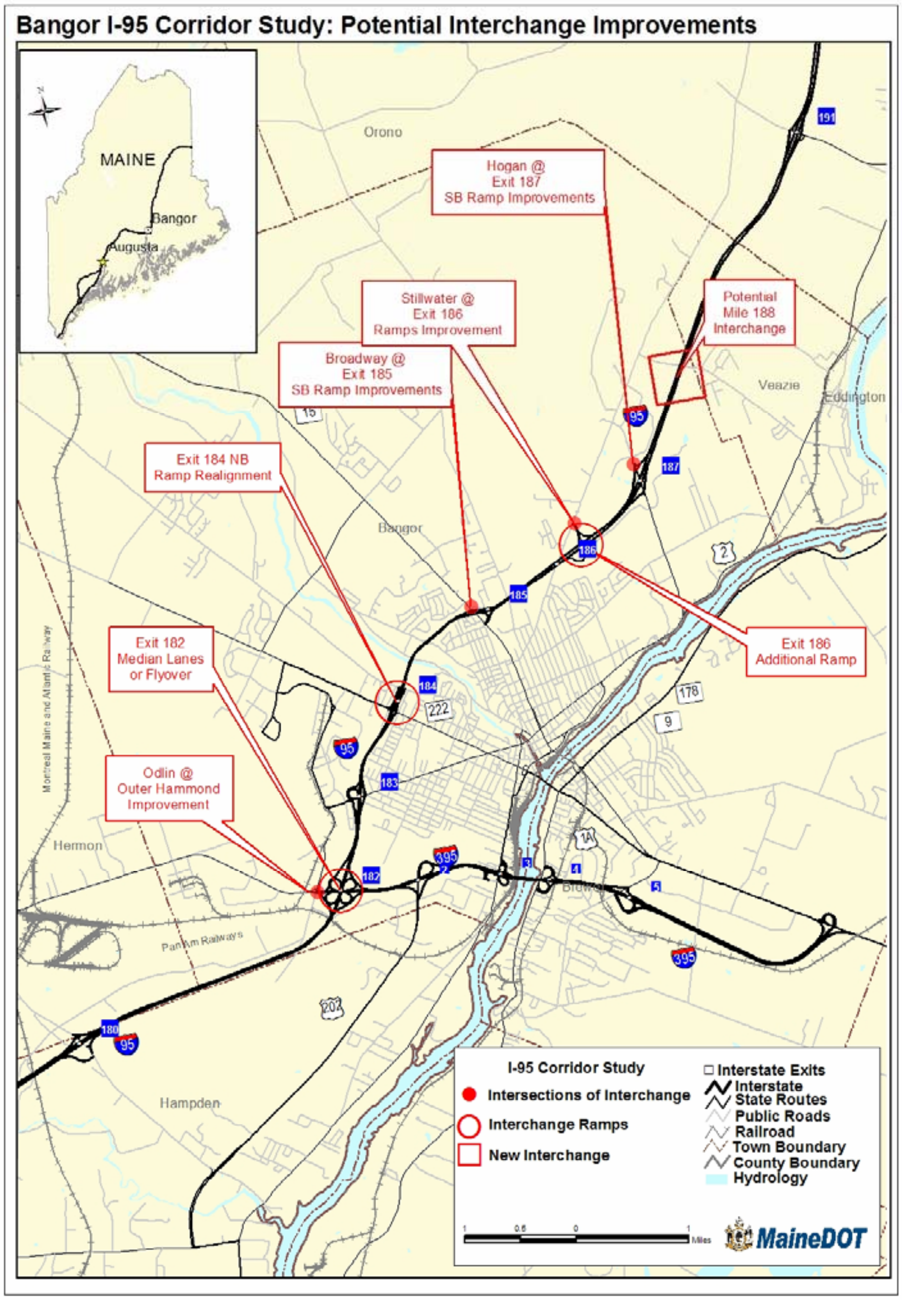
Figure 4.3 Potential Park & Ride Lot Improvements



4. Interchange Improvements

In this study, potential interchange improvements fall into three broad categories: improvements to intersections at or near interchanges, and mainline improvements that add or realign ramps or mainline through lanes at existing interchanges, and new interchanges. These potential improvements are located on Figure 4.4.

Figure 4.4 Potential Interchange Improvement Locations



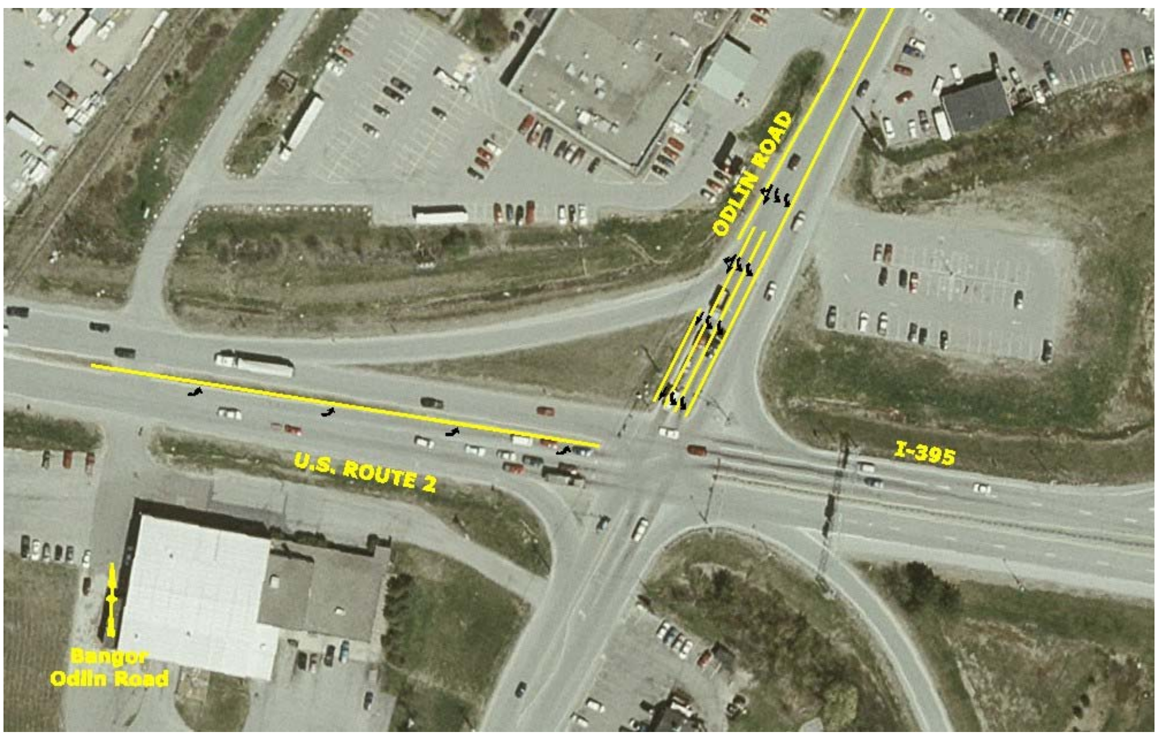
Improvements to Intersections

Potential improvements to intersections have been identified at four interchanges: Exits 182, 185, 186, and 187.

Exit 182

Near Exit 182, at the intersection of Odlin Road and Outer Hammond Street, potential intersection improvements have been identified to address future queuing and level of service problems. On the eastbound approach along Outer Hammond, the left-turn lane would be extended. On the southbound approach along Odlin Road, a second left-turn lane would be added. The potential improvements at this intersection are shown in Figure 4.5.

Figure 4.5 Potential Odlin Road Intersection Improvements



Exit 185

At the Exit 185 intersection of Broadway with the I-95 southbound ramps, future queuing problems would be addressed by an extended right-turn lane on the southbound off-ramp. This potential intersection improvement is shown in Figure 4.6.

Figure 4.6 Potential Southbound Off-Ramp at Broadway Exit 185

Exit 186

At the intersection of Stillwater Avenue and the Exit 186 ramps, future queuing problems would be addressed by extending the lengths of Stillwater Avenue northbound right-turn and left-turn lanes and by converting the southbound right-turn lane to a shared through-right-turn lane, with an added lane reduced back to one southbound lane south of the intersection. The potential intersection improvement on Stillwater Avenue is shown in Figure 4.7. A similar action has been stipulated as a future Stillwater Avenue improvement connected with a land-use development project in the Bangor Mall area.

Figure 4.7 Potential Stillwater Avenue Intersection Improvement at Exit 186

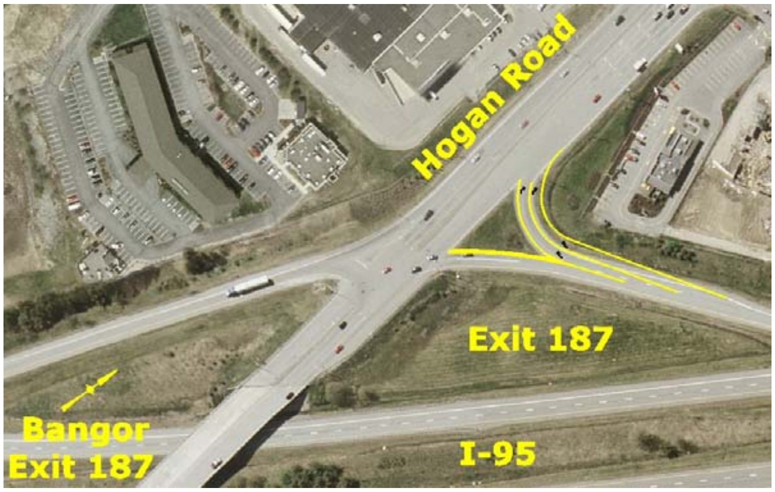
Exit 187

At Exit 187, poor levels of service at the intersection of Hogan Road and Bangor Mall Boulevard would be addressed by changes at the intersection of Hogan Road and the southbound I-95 ramps. One eastbound through lane would be converted to a shared through-right-turn to improve lane utilization in the eastbound direction. This would require that all right turns to the southbound on-ramp be made under signal control, and a second on-ramp lane would be needed for an appropriate distance to allow the merging of on-ramp traffic. The southbound on-ramp improvement could extend to Exit 186 as an auxiliary lane between interchanges. This potential intersection improvement is shown in Figure 4.8.

Figure 4.8 Potential Hogan Road Improvement at Southbound On-Ramp

Also at Exit 187, a high crash location would be addressed by converting the yield-controlled right-turn lane at the end of the southbound off-ramp to two right-turn lanes controlled by traffic signal. The potential improvement at the high crash location is shown in Figure 4.9.

Figure 4.9 Potential Hogan Road Improvement at Southbound Off-Ramp



Ramp Improvements

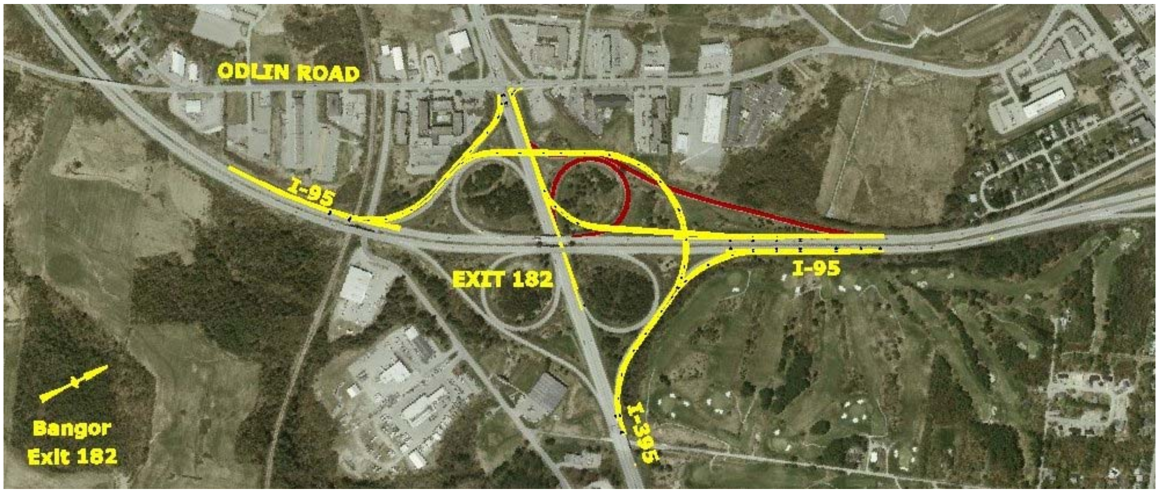
Potential mainline ramp improvements have been identified at the following interchanges: Exits 182, 184, 186, and 187.

Exit 182

At Exit 182, two potential improvements have been identified: the flyover option and the median lanes option. These options are shown in Figures 4.10 and 4.11.

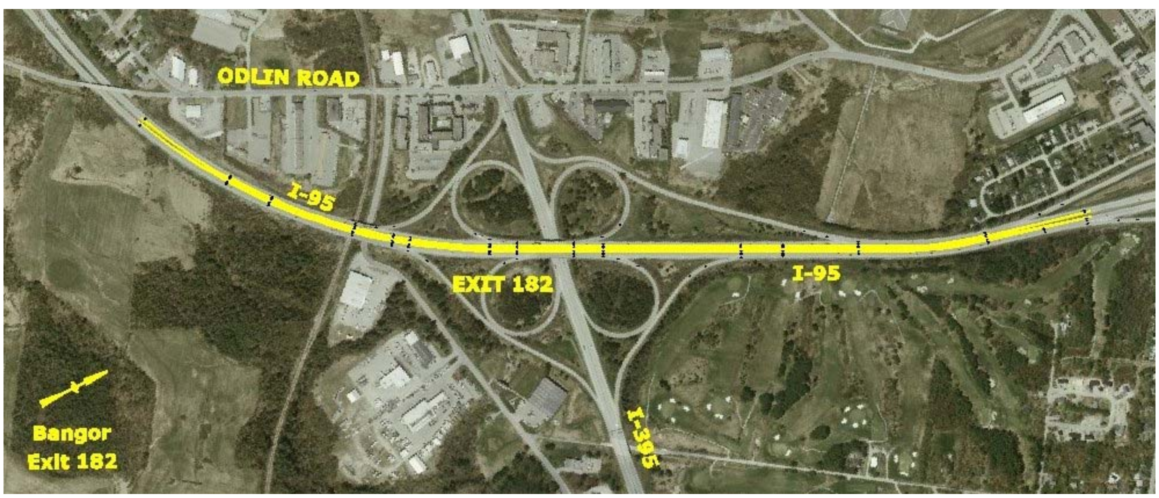
The intent of the flyover option is to eliminate two of the three high crash locations located at Exit 182. Under this option, the southbound loop on-ramp would be replaced by a flyover ramp from I-395 westbound to I-95 southbound. This flyover would require grade-separated crossings of the I-95 and I-395 mainlines, widening of existing bridges over the Pan Am Railway and Perry Road, and modifications to certain existing ramps. The option would also include relocating the I-95 southbound off-ramp to I-395 westbound to create more separation between the ramp and the Odlin Road intersection.

Figure 4.10 Potential Flyover Option at Exit 182



The median lanes option would relocate the I-95 through lanes toward the median to provide an extra northbound and southbound auxiliary lanes to serve on- and off-ramp traffic using the Exit 182 weaving sections along the I-95 mainline. The added auxiliary lanes would reduce conflicts between through traffic and ramp traffic at the interchange. The option would involve widening or replacing the existing I-95 bridges over I-295.

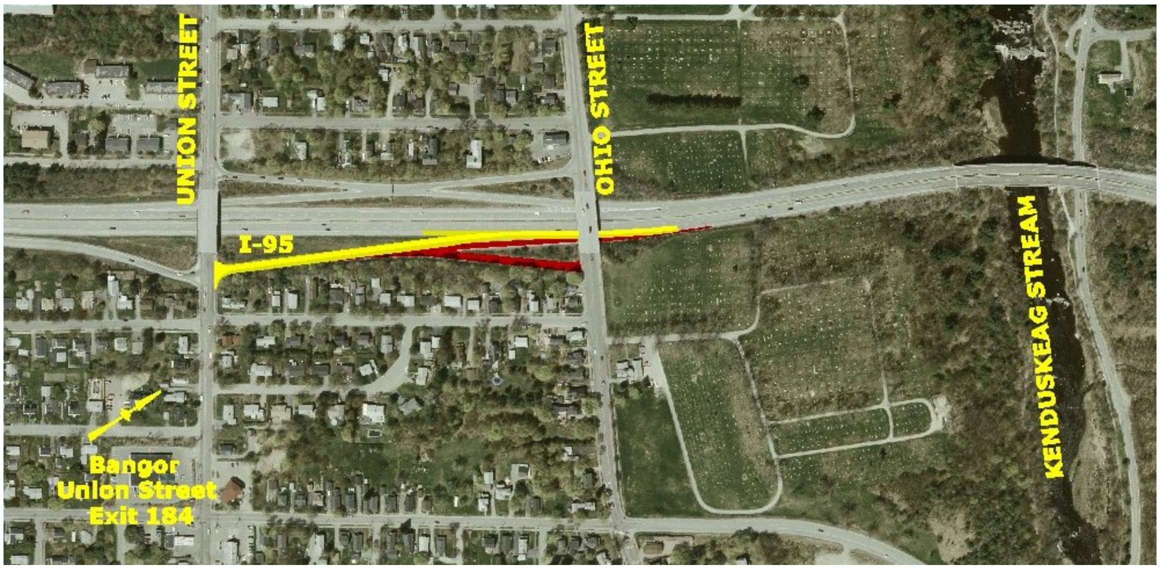
Figure 4.11 Median Lanes at Exit 182



Exit 184

To address high crash locations on the northbound side of Exit 184, the northbound on-ramp would be realigned in a way that would increase the acceleration length without impacts to the cemetery and the bridge over the Kenduskeag Stream. The improved acceleration length would address crashes near the merge point of the on-ramp. Included as part of the interchange improvement would be the closure of the on-ramp connection to Ohio Street. Elimination of this direct connection from the northbound ramps intersection at Union Street would address crashes that involve northbound ramp-to-ramp traffic and Union Street traffic. This potential interchange improvement is shown in Figure 4.12.

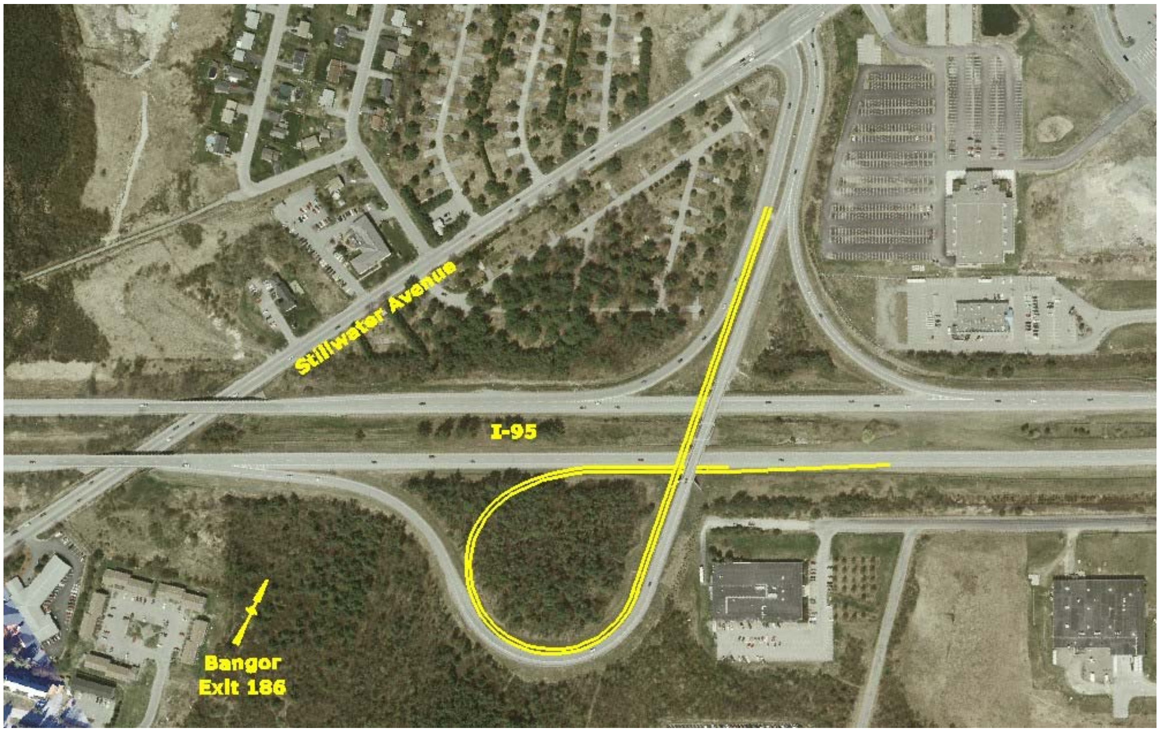
Figure 4.12 NB On-Ramp Realignment at Exit 184



Exit 186

The construction of a fourth ramp, the northbound on-ramp, at Exit 186 would have the potential to address future congestion issues at Hogan Road by providing traffic relief for Hogan Road near the Exit 187 interchange. The potential improvement would involve the construction of the unbuilt loop ramp at Exit 186, creating a full-service four-ramp interchange. Such an improvement could attract traffic that would otherwise use Hogan Road to gain access to I-95 Exit 187 northbound. Figure 4.13 shows the potential northbound on-ramp at Exit 186.

Figure 4.13 Potential NB On-Ramp at Exit 186.



New Interchange

As an alternative to improving existing interchanges to address traffic congestion issues on Hogan Road, a new interchange north of Exit 187 could relieve Hogan Road of some of the traffic that uses Exit 187. For the purpose of analyzing the potential of a new interchange to relieve Hogan Road congestion, the concept of a diamond (four-ramp) interchange at Chase Road was proposed. Chase Road is a local road that crosses over I-95 approximately one mile north of Hogan Road. Chase Road connects Stillwater Avenue with the Town of Veazie's village center at Route 2. The land use on Chase Road is a combination of rural and low-density residential development.

In the Bangor I-95 Corridor Study, the concept of a new interchange north of the Study Area is only evaluated at an initial feasibility level as a tool to relieve future congestion issues at Hogan Road. If a new interchange were to be considered beyond this study, it would require a much more rigorous economic and environmental feasibility assessment than the scope of this study allows.

5. Other

Other potential actions that do not fit into the strategies described on previous pages are listed below.

Signing Changes

Because many of the high crash locations on I-95 involve conflicts between vehicles at or near interchange ramps, signing changes could be made to encourage more I-95 through traffic to use the inner travel lane and avoid conflicts with vehicles using interchange ramps. Such signing changes could include the elimination of “Keep Right Except to Pass” signs on the I-95 approaches to Bangor and the overhead sign designation of the inner travel lane for “Thru Traffic”.

Median Barrier

A median barrier between Mile 183 and Mile 185 has been proposed as an action to improve safety along the narrowest parts of I-95, where the median width between travel lanes is 10 to 16 feet. The concept would be to construct a continuous concrete barrier for approximately 1.6 miles, starting north of Exit 183 (Hammond Street), continuing through Exit 184, and extending beyond the Kenduskeag Stream crossing. The potential benefits of the concrete median barrier would be the improved ability to prevent head-on crashes involving vehicles crossing the median and the low maintenance characteristics of the barrier, which would reduce the exposure of highway maintenance crews to I-95 traffic.

V Analysis

The potential actions identified in Chapter 4 for further evaluation were analyzed to determine their potential impact on traffic safety and operations, effectiveness at improving safety and mobility, quantifiable benefits and costs, and potential implementation challenges. The analysis also included an assessment of cost-effectiveness and possible implementation priority.

A. Auxiliary Lanes

Tables 5.1 and 5.2 show the effect of lengthened accel/decel lanes would have on peak-hour levels of service at ramp junctions in 2030. They would not affect the levels of service for mainline segments between ramp junctions. These lengthened auxiliary lanes are listed in Table 4.3.

As Table 5.1 shows, the improvements would reduce the number of ramp junctions at LOS D in the AM peak hour from seven down to four. All of these ramp junctions are in the northbound direction. The southbound ramp junctions would also show better levels of service overall.

Table 5.1 2030 AM Peak-Hour LOS at Ramp Junctions

		Level of Service					
		A	B	C	D	E	F
Existing On/Off Ramps	South Bound		10	5			
	North Bound		3	3	7		
Improved On/Off Ramps	South Bound	1	11	3			
	North Bound		3	6	4		

In the PM peak hour, shown in Table 5.2, the lengthened accel/decel lanes would also improve levels of service in both the northbound and southbound directions. Overall, the numbers of ramp junctions at LOS D would be reduced from seven to four.

Table 5.2 2030 PM Peak-Hour LOS at Ramp Junctions

		Level of Service					
		A	B	C	D	E	F
Existing On/Off Ramps	South Bound		1	9	5		
	North Bound		4	7	2		
Improved On/Off Ramps	South Bound		2	10	3		
	North Bound		5	7	1		

B. Intelligent Transportation Systems

The intelligent transportation systems (ITS) strategy described in Chapter 4 would include several elements that would work together to improve I-95 safety and mobility. These elements include traffic monitoring, motorist information, service patrols, and a control center. Working together as a freeway management system, the ITS strategy could have a beneficial impact on mobility and safety.

Table 5.3 shows the potential impact that the ITS strategy can have on improving mobility. The ability to detect incidents and respond to them more quickly would reduce the average duration of the incidents. In the Bangor I-95 Corridor, there are more than 1400 incidents per year, with an average duration of 52 minutes. Based on experiences in other states, an ITS strategy with service patrols can reduce the duration of incidents by 14%. When an incident results in a temporary reduction in highway capacity below the level of traffic demand, queues of delayed vehicles form on the approaches to the incident location. Reducing the average queue duration shortens the length of the queue that is formed and shortens the time needed for the queue to dissipate after the capacity restriction has been cleared. On I-95 in Bangor, a 14% reduction in incident duration would result in a 20% reduction in delay caused by incidents.

Table 5.3 Potential Impact of ITS on Mobility in the Bangor I-95 Corridor

	Average Incident Duration (minutes)	2030 Delay Due to Incidents		
		Total (veh-hrs)	Change (veh-hrs)	% Change
Study Area Baseline	52	259000	-	-
14% Reduction in Duration	45	207000	-52000	-20%

Table 5.4 shows the potential impact the ITS strategy can have on traffic safety. With improved information about conditions on the highway ahead, motorists can be prepared to reduce speed or avoid the area by seeking an alternate route to their destination. One

metropolitan area reported a 3% reduction in the frequency of crashes because of improved motorist information. In Bangor, this would mean the elimination of four crashes per year on the I-95 mainline. In addition to the safety benefits of reduced injuries and property damage, each eliminated crash would also eliminate the delays caused by a highway capacity reduction at the crash scene. This is a further reduction in the delay due to incidents shown in Table 5.3.

Table 5.4 Potential Impact of ITS on Safety in the Bangor I-95 Corridor

	Number of Crashes			2030 Delay Due to Crashes		
	Annual	Change	% Change	Total (veh-hrs)	Change (veh-hrs)	% Change
Study Area Baseline	135	-	-	207000	-	-
3% Reduction in Crashes	131	-4	-3%	201000	-6000	-3%

C. Transportation Demand Management

The traffic impact of a proposed park & ride lot can be difficult to predict. However, the proposed location of a park & ride lot at Exit 185 has the advantages of being next to major highway routes (I-95 and Route 15), a major resident population (the east side of Bangor), connecting bus routes (the BAT), and the Broadway commercial district. These are factors that can attract users to the Exit 185 lot.

A recent survey of users of park & ride lots in Maine showed that each use by a would-be driver removes an average of 110 vehicle-miles from the highway system. Survey data from the Odlin Road park & ride lot near Exit 182 indicated that 22 of the spaces in the lot were being used and that the average user of that lot removed 230 vehicle-miles from the system. Table 5.5 shows the potential annual savings in vehicle-miles traveled (VMT) for utilizing a park & ride lot for 250 days per year. For the purpose of the I-95 Corridor Study, a reasonable estimate of VMT savings at Exit 185 would be 550,000 vehicle-miles annually.

Table 5.5 A Range of Potential VMT Savings for Park & Ride Lot at Exit 185

Potential Annual VMT Savings of Park & Ride Lot		
Park & Ride Utilization (users / day)	Average Round Trip Length Statewide (110 miles)	Exit 182 (230 miles)
	VMT saved	VMT saved
10	275000	575000
20	550000	1150000
30	825000	1725000
40	1100000	2300000
50	1375000	2875000

D. Interchange Improvements

1. Intersections at Interchanges

Table 5.6 shows the impact that potential intersection improvements identified in Chapter 4 would have on future PM peak-hour operating conditions at intersections located at or near Exits 182, 185, 186, and 187.

Table 5.6 Intersection LOS

Interchange Location and Intersection		**Level of Service**		**Delay**	**V/C Ratio**
		No-Build	Improved	(sec/veh)	
Exit 182	Outer Hammond and Odlin Rd	E/D	D	41.5	0.67
Exit 185	Falvey Street and Broadway	A	A	8.1	0.48
	I-95 SB and Broadway	D	C/D	34.2	0.81
	I-95 NB and Broadway	C	C	24.2	0.75
Exit 186	I-95 and Stillwater Ave	C	C	31.9	0.85
	Bangor Mall and Stillwater Ave	C	C	23.8	0.73
Exit 187	Bangor Mall and Hogan Road	F	E	63.4	0.88
	I-95 SB and Hogan Road	C	B	13.1	0.69
	I-95 NB and Hogan Road	C	C	28.3	0.85

Exit 182

The potential left-turn-lane improvements on eastbound and southbound approaches of the intersection of Odlin Road and Outer Hammond Street would reduce the delay and improve the level of service at that intersection from E/D (E, almost D) to LOS D.

Exit 185

The potential extension of the right-turn lane on the intersection approach from the southbound off-ramp would reduce intersection delay and improve the level of service from D to C/D (C, almost D). Other Broadway intersections at the Exit 185 interchange would not have a change in level of service.

Exit 186

At the intersection of Stillwater Avenue and the Exit 186 ramps, the potential approach-lane modifications would provide a modest reduction in delay, but the level of service of the intersections would remain at C.

Exit 187

The potential action to increase right-turn capacity at the Hogan Road intersection with the southbound ramps would reduce delay and improve intersection level of service from

C to B. In addition, the action would reduce delay and improve the level of service from F to E at the intersection of Hogan Road and Bangor Mall Boulevard by improving the utilization of available lanes at that intersection.

2. Interchange Ramps

The impact of interchange ramp improvements was analyzed for Exits 182, 184, and 186, as well as a potential interchange north of Exit 187. Actions at Exit 182 and 184 are intended to improve the operation of those interchanges by relocating lanes at those locations. For the latter two locations, the main objective would be to relieve traffic congestion on Hogan Road, where Exit 187 provides access to Bangor Mall Boulevard and other commercial areas.

Exit 182

At Exit 182, two major options were identified to address safety and mobility issues: a median lanes option, which would shift through lanes toward the median to allow an additional auxiliary lane in each direction, and the flyover option, which would replace one of the cloverleaf loop ramps with a flyover ramp. Both would address one or more High Crash Locations and also provide mobility benefits for some of the interchange users.

Table 5.7 summarizes the overall impacts of the two options. The median lanes option would provide the larger amount of mobility benefit by reducing delays for I-95 traffic moving through the northbound and southbound weaving sections. These changes would address one high crash location. The flyover would address two high crash locations and provide mobility benefits for users of the flyover ramp.

Table 5.7 Exit 182 Interchange Options

Potential Action(s)	Mobility Impact	Safety Impact
	2035 VHT Savings	HCLs Addressed
Median Lanes	13644	1
Flyover	2685	2

Exit 184

At Exit 184, potential improvement actions could address three high crash locations: one on Union Street at the northbound ramps and two on I-95 at the northbound on-ramp. Table 5.8 summarizes the safety impact of the improvement actions on the number of crashes at those locations. The closure of the Ohio Street cut-off ramp would reduce the number of crashes at the Union Street intersection, by eliminating a major pattern of crashes involving northbound off-ramp traffic attempting to cross Union Street. The shift in location of the northbound on-ramp would improve the safety of traffic merging into I-95 mainline traffic.

Table 5.8 Safety Impact of Exit 184 Improvement Actions

High Crash Location	Number of Crashes		
	Annual	Change	% Change
Union @ NB Ramps	9	-4	-44%
I-95 @ NB On-Ramp	12	-3	-25%
Combined	21	-7	-33%

Exits 186, 187, and Beyond

Improving traffic operations around the Exit 187 (Hogan Road) interchange is the main objective of potential major improvement actions at Exit 186 and north of Exit 187. Both the addition of a northbound on-ramp at Exit 186 and a new interchange at Mile 188 could provide some congestion relief to Hogan Road by diverting traffic that would otherwise be using Exit 187. Either action could be implemented along with the potential intersection improvements at Exit 187. Table 5.9 summarizes the 2035 traffic conditions at the Hogan Road intersections for the no-build condition, for the Hogan Road intersection improvement actions, for the two major interchange actions, and for the combination of the intersection actions and each of the major interchange actions.

Table 5.9 Exit 187 Interchange Options

Potential Action(s)	Exit 187 Intersection	Level of Service	Delay	V/C Ratio
			(sec/veh)	
No-Build	Bangor Mall and Hogan Road	F	101.5	0.86
	I-95 SB and Hogan Road	C	22.1	0.78
	I-95 NB and Hogan Road	C	28.7	0.88
Intersection Improvement	Bangor Mall and Hogan Road	E	63.4	0.88
	I-95 SB and Hogan Road	B	13.1	0.69
	I-95 NB and Hogan Road	C	28.3	0.85
NB On-Ramp at Exit 186	Bangor Mall and Hogan Road	E	75.8	0.84
	I-95 SB and Hogan Road	C	25.9	0.77
	I-95 NB and Hogan Road	E/F	79.4	0.95
New Interchange (Exit 188)	Bangor Mall and Hogan Road	E	71.8	0.90
	I-95 SB and Hogan Road	C	28.4	0.85
	I-95 NB and Hogan Road	C	26.5	0.83
Intersection Improvement with NB On-Ramp at Exit 186	Bangor Mall and Hogan Road	D	46.4	0.86
	I-95 SB and Hogan Road	B	15.5	0.60
	I-95 NB and Hogan Road	E	78.4	0.91
Intersection Improvement with New Interchange (Exit 188)	Bangor Mall and Hogan Road	D	53.9	0.88
	I-95 SB and Hogan Road	B	13.7	0.92
	I-95 NB and Hogan Road	C	31.6	0.86

As Table 5.9 shows, each of the individual actions would improve the LOS F at the intersection of Hogan Road and Bangor Mall Boulevard to LOS E. The intersection improvement action would also improve the LOS C at the southbound ramps intersection to LOS B. However, the additional Exit 186 ramp would likely reduce the LOS C at the Exit 187 northbound ramps intersection to LOS E because it would increase volumes between the interchanges for short-distance travel. Inclusion of the Hogan Road intersection improvement action would improve the effectiveness of either major interchange action, with a LOS D at the Bangor Mall Boulevard intersection. The combination of the intersection improvement action with a new interchange provided the best overall result, with all three of the Hogan Road intersections at LOS D or better.

E. Other

1. Signing

Although evaluating the potential impact of signing changes that would reduce conflict between I-95 through traffic and interchange traffic would be difficult, available traffic volume data shows that interchange traffic is a major component of the traffic stream. Table 5.10 shows the amounts and percentages of traffic on mainline segments between interchanges that is composed of on-ramp traffic from the upstream interchange or off-ramp traffic to the downstream interchange.

Table 5.10 Ramp Traffic Between Interchanges

Direction	Segment	Mainline AADT	Upstream On-Ramp(s)	Downstream Off-Ramp(s)	Combined On- & Off-Ramps		Remaining Non-Ramp AADT	
Northbound	Exit 180 (Coldbrook) to Exit 182 (I-395)	13,130	3,530	5,730	9,260	71%	3,870	29%
	Exit 182 (I-395) to Exit 183 (Hammond)	20,220	12,820	2,380	15,200	75%	5,020	25%
	Exit 183 (Hammond) to Exit 184 (Union)	20,340	4,280	2,090	6,370	31%	13,970	69%
	Exit 184 (Union) to Exit 185 (Broadway)	24,280	6,030	5,500	11,530	47%	12,750	53%
	Exit 185 (Broadway) to Exit 186 (Stillwater)	23,730	4,950	5,390	10,340	44%	13,390	56%
	Exit 186 (Stillwater) to Exit 187 (Hogan)	18,340	0	7,900	7,900	43%	10,440	57%
	Exit 187 (Hogan) to Exit 191 (Kelley)	14,720	4,280	3,440	7,720	52%	7,000	48%
Southbound	Exit 191 (Kelley) to Exit 187 (Hogan)	15,600	4,290	4,320	8,610	55%	6,990	45%
	Exit 187 (Hogan) to Exit 186 (Stillwater)	20,160	8,880	1,770	10,650	53%	9,510	47%
	Exit 186 (Stillwater) to Exit 185 (Broadway)	23,850	5,460	5,040	10,500	44%	13,350	56%
	Exit 185 (Broadway) to Exit 184 (Union)	24,380	5,570	6,350	11,920	49%	12,460	51%
	Exit 184 (Union) to Exit 183 (Hammond)	20,130	2,100	2,340	4,440	22%	15,690	78%
	Exit 183 (Hammond) to Exit 182 (I-395)	20,250	2,460	11,580	14,040	69%	6,210	31%
	Exit 182 (I-395) to Exit 180 (Coldbrook)	14,230	5,560	4,880	10,440	73%	3,790	27%

On- and off-ramp traffic accounts for about 45 to 50% of the AADT on most mainline segments of I-95 through Bangor. The percentage is lower (around 30%) between Exits 183 and 184, but the percentage is higher (70 to 75%) between Exit 183 and Exit 180 (south of the Study Area). The volume of ramp traffic between Exits 183 and 182, at 15,200 northbound and 14,040 southbound, is also the highest in the Study Area. These volumes and percentages suggest that non-ramp traffic should be in the left lane, especially in the Exit 182 area, to minimize conflicts between ramp traffic and through traffic.

The potential removal of “Keep Right Except to Pass” signs on the I-95 approaches to Bangor may help reduce the amount of through traffic using the right lane. If more action is needed to reduce the conflicts, overhead signing could be modified to encourage through traffic to use the left lane. This could be especially useful on the approaches to Exit 182 and could have an effect similar to the median lanes option by providing more separation between through traffic and ramp traffic at Exit 182.

2. Median Barrier

The potential action to install a concrete median barrier along the narrowest part of the I-95 median in Bangor would be intended to improve safety and reduce maintenance costs. It would replace the guardrail and glare shields currently in use. Maintenance costs would be reduced by eliminating the need to repair guardrail and glare shields. Reduced need for repairs would improve the safety of highway maintenance workers and highway users by reducing the need to set up maintenance work zones on I-95. The concrete barrier would also reduce the likelihood of a vehicle straying across the median into the opposing flow of traffic.

However, a concrete barrier could have unintended consequences regarding crash safety. Vehicles that leave the travel lanes and crash into a concrete barrier are more likely to rebound and reenter the travel lanes than vehicles that crash into a guardrail. A recent study of lane departure crashes on I-295 in Portland, Maine, showed that 57% of crashes into a concrete barrier rebounded into the travel lane while the percentage for crashes into guardrail was 26%. A full evaluation of the overall effectiveness of a median barrier would require a more detailed analysis beyond the scope of the Bangor I-95 Corridor Study.

F. Effectiveness, Cost, and Challenges

In the this part of the analysis, the candidate actions have been compared in terms of effectiveness at improving safety and mobility, in cost to implement, and in the challenges presented by implementation. The effectiveness and the cost of alternatives also have been combined into a benefit/cost analysis to measure relative economic feasibility.

1. Effectiveness

In Table 5.11, the effectiveness of each of the candidate actions is summarized. Each action would have an impact on safety or mobility or both. For auxiliary lane improvements modest improvements would be expected in safety and mobility, but a larger safety impact would be expected where there are high crash locations. For intelligent transportation systems, fewer incidents, shorter incidents, fewer crashes, and reduced delays would be expected. Use of TDM facilities and services would reduce vehicle-miles traveled. In general, improvements at intersections at or near interchanges would reduce delays at those intersections, but could improve safety as well. The major interchange improvement actions would be reduced crashes and/or reduced delays on intersecting roads such as Hogan Road. Effective signing improvements would reduce conflicts between vehicles, which affect both safety and mobility. A median barrier would have safety impacts, but it could also reduce maintenance costs.

Table 5.11 Effectiveness of Actions

Strategies	Actions	Locations	Safety Impact	Mobility Impact
Auxiliary Lanes	Increase acceleration and/or deceleration lengths at interchange ramp junctions	NB 182A off-ramp	reduce vehicle conflicts	minor savings in VHT, some improvements in level of service
		NB 182B on-ramp		
		NB 183 on-ramp		
		NB 184 off-ramp		
		NB 184 on-ramp	address 2 HCLs	
		NB 185 off-ramp	address HCL	
		NB 185 on-ramp	address 2 HCLs	
		NB 187 on-ramp	reduce vehicle conflicts	
		SB 187 on-ramp		
		SB 186 on-ramp		
		SB 185 off-ramp		
		SB 185 on-ramp		
		SB 184 on-ramp		
		SB 183 on-ramp (northern)		
		SB 182A on-ramp		
Intelligent Transportation Systems (ITS)	Establish traffic monitoring facilities	I-95 (and I-395)	reduce crashes on I-95	reduce delays on I-95
	Install variable message signing	I-95 (and I-395)		
	Establish service patrol	I-95 (and I-395)	shorten duration of incidents	
Transportation Demand Management (TDM)	Establish park & ride facility	Exit 185 area		reduce VMT
	Increase carpooling and vanpooling	Greater Bangor area		
Interchange Improvements	Improve intersections at/near interchanges	Exit 182, Odlin @ Outer Hammond		reduce delays
		Exit 185, Broadway @ SB ramps		reduce delays
		Exit 186, Stillwater @ ramps		minor change
		Exit 187, Hogan @ SB off-ramp	address HCL	
		Exit 187, Hogan @ SB on-ramp		reduce delays
	Construct flyover ramp	Exit 182, WB to SB	address 2 HCLs	
	Construct median lanes	Exit 182, NB and SB	address HCL	
	Realign northbound on-ramp	Exit 184	address 3 HCLs	
	Construct northbound on-ramp	Exit 186		mixed results
	Construct new interchange	north of Exit 187		reduce delays
Other	Modify signing	I-95	reduce vehicle conflicts	
	Install median barrier	Between Mile 183 and Mile 186	mixed results	

2. Cost

The costs of potential actions were estimated in terms of 2010 dollars, mainly from implementation (design and construction) costs, except for those with a major operations and maintenance component, such as a service patrol. The costs of actions ranged from under $100,000 for some auxiliary lane improvements to several million dollars for major interchange projects, as summarized in Table 5.12. Some actions, such as park & ride facilities and the median barrier were not estimated because more detailed investigation would be needed to determine a cost. One action, installation of variable message signs was not estimated because the facilities already exist.

Table 5.12 Costs of Actions

Actions	Locations	Capital Cost
Increase acceleration and/or deceleration lengths at interchange ramp junctions	NB 182A off-ramp	$75,000
	NB 182B on-ramp	$85,000
	NB 183 on-ramp	$175,000
	NB 184 off-ramp	$90,000
	NB 184 on-ramp	undetermined
	NB 185 off-ramp	$70,000
	NB 185 on-ramp	$140,000
	NB 187 on-ramp	$130,000
	SB 187 on-ramp	$130,000
	SB 186 on-ramp	$130,000
	SB 185 off-ramp	$70,000
	SB 185 on-ramp	$160,000
	SB 184 on-ramp	$110,000
	SB 183 on-ramp (northern)	$180,000
	SB 182A on-ramp	$75,000
Establish traffic monitoring facilities	I-95 (and I-395)	undetermined
Install variable message signing	I-95 (and I-395)	(in place) $0
Establish service patrol	I-95 (and I-395)	(annual) $105,000
Establish park & ride facility	Exit 185 area	variable
Increase carpooling and vanpooling	Greater Bangor area	variable
Improve intersections at/near interchanges	Exit 182, Odlin @ Outer Hammond	$470,000
	Exit 185, Broadway @ SB ramps	$190,000
	Exit 186, Stillwater @ ramps	$690,000
	Exit 187, Hogan @ SB off-ramp	$300,000
	Exit 187, Hogan @ SB on-ramp	$1,300,000
Construct flyover ramp	Exit 182, WB to SB	$30,000,000
Construct median lanes	Exit 182, NB and SB	$15,500,000
Realign northbound on-ramp	Exit 184	$650,000
Construct northbound on-ramp	Exit 186	$5,000,000
Construct new interchange	north of Exit 187	$9,000,000
Modify signing	I-95	variable
Install median barrier	Between Mile 183 and Mile 186	undetermined

3. Implementation Challenges

As part of the alternatives analysis, implementation challenges were assessed for all of the candidate improvement actions. The findings of the assessment are summarized in Table 5.13.

Table 5.13 Implementation Challenges

Strategies	Actions	Locations	Implementation Challenges
Auxiliary Lanes	Increase acceleration and/or deceleration lengths at interchange ramp junctions	NB 182A off-ramp	minimal
		NB 182B on-ramp	
		NB 183 on-ramp	
		NB 184 off-ramp	
		NB 184 on-ramp	right-of-way and bridge impacts
		NB 185 off-ramp	minimal
		NB 185 on-ramp	
		NB 187 on-ramp	
		SB 187 on-ramp	
		SB 186 on-ramp	
		SB 185 off-ramp	
		SB 185 on-ramp	
		SB 184 on-ramp	
		SB 183 on-ramp (northern)	
		SB 182A on-ramp	
Intelligent Transportation Systems (ITS)	Establish traffic monitoring facilities	I-95 (and I-395)	implementation plan for freeway management system
	Install variable message signing	I-95 (and I-395)	
	Establish service patrol	I-95 (and I-395)	
Transportation Demand Management (TDM)	Establish park & ride facility	Exit 185 area	location selection
	Increase carpooling and vanpooling	Greater Bangor area	minimal
Interchange Improvements	Improve intersections at/near interchanges	Exit 182, Odlin @ Outer Hammond	possible right-of-way impact
		Exit 185, Broadway @ SB ramps	minimal
		Exit 186, Stillwater @ ramps	
		Exit 187, Hogan @ SB off-ramp	
		Exit 187, Hogan @ SB on-ramp	
	Construct flyover ramp	Exit 182, WB to SB	cost, possible right-of-way impact
	Construct median lanes	Exit 182, NB and SB	cost
	Realign northbound on-ramp	Exit 184	coordination with bridge projects
	Construct northbound on-ramp	Exit 186	cost, mixed mobility impact
	Construct new interchange	north of Exit 187	cost, environmental effects
Other	Modify signing	I-95	minimal
	Install median barrier	Between Mile 183 and Mile 186	potential cost, mixed safety impact

Auxiliary Lanes

For most of the auxiliary lane actions, the implementation challenges would be minimal. Generally, the lengthening of acceleration and deceleration lanes on I-95 can be accomplished well within the I-95 right-of-way. The one exception would be extension of the acceleration lane of the Exit 184 northbound on-ramp, where right-of-way is narrow through the cemetery and the nearby bridge over the Kenduskeag Stream limits any extension in a northbound direction. For auxiliary lane actions, and any other actions involving construction in this Corridor, planning for maintenance of traffic is an important consideration, but it is not an obstacle to implementation.

Intelligent Transportation Systems

ITS actions generally involve a minimum of construction. The major challenge of implementing ITS actions in the Corridor would be the planning necessary to develop a coordinated freeway management system.

Transportation Demand Management

For the potential TDM actions, the major challenge may be finding a park & ride location near Exit 185 that is convenient, available and affordable. Convenience is necessary to attract users. Availability will require a willing seller or host of a park & ride lot. Affordability will require either a site that is either already a parking lot or a site that can be economically converted to a parking lot.

Interchange Improvements

Generally, intersection improvements at or near interchanges can be completed within the right-of-way. The main exception may be at the intersection of Odlin Road and Outer Hammond Street, where widening on the southbound Odlin Road approach could require additional right-of-way.

Each of the major interchange improvement actions would have its own unique challenges. At Exit 182, both the flyover option and the median lanes option have very high capital costs, and the flyover could have right-of-way impacts as well. At Exit 184, the realignment of the northbound on-ramp should be coordinated with planned projects to replace both the Union Street and Ohio Street bridges over I-95. At Exit 186, the major challenges of the added fourth interchange ramp would be the capital cost and the mixed results it would have on Hogan Road traffic impacts. North of Exit 187, a potential new interchange would have a high capital cost and require a substantial environmental planning effort that complies with the National Environmental Policy Act and the Maine Sensible Transportation Policy Act.

Other Actions

The challenges of signing improvements would be minimal, although new overhead signs would have a capital cost element.

For the potential median barrier, the challenge would be finding the effective and affordable median treatment. A more detailed analysis of the median issues would likely be needed to find the most appropriate solution.

4. Benefit/Cost

A benefit/cost analysis of the candidate actions was conducted to determine the relative cost-effectiveness of the actions in terms of the value of safety and mobility benefits per unit of cost. The analysis offered an indication of economic feasibility and priority. To evaluate the benefits of potential actions, the mobility and safety impacts of the actions were converted into benefits, expressed in 2010 dollars for the planning horizon year, 2030. The mobility benefits may include reductions in vehicle-miles traveled (VMT) and vehicle-hours traveled (VHT). The safety benefits come from reduced crash costs. The costs from Table 5.12 were converted into an annualized cost, with an assumed discount rate (6%) over the life of the action, 20 years for most actions and 10 years for intersection improvements.

Table 5.14 summarizes the benefits and costs for potential actions analyzed. Also shown is a benefit/cost (b/c) ratio based on the 2030 benefits and the annualized cost, all in 2010 dollars. An action with a b/c ratio greater than 1.00 demonstrates economic feasibility by having benefits that exceed costs. An action showing a v/c ratio less than 1.00 is considered economically infeasible and is usually dismissed from further consideration, modified to improve its economic feasibility, or reconsidered in a future study.

Table 5.14 Benefit/Cost at Future Traffic Volumes

Location	Description	Total Annual Reduction in Delay (vht)	Annual Mobility Benefit	Annual Safety Benefit	Mobility and Safety Benefits	Capital Cost	Annualized Capital Cost	B/C Ratio
Ramp Junctions throughout Study Area	Increase Accel/Decel Lane Lengths	4563	$50,200	$72,100	$122,300	$1,600,000	$139,000	0.88
Service Patrol Zone (as part of freeway management system)	Incident Response	51560	$642,000	$188,000	$830,000	(operating cost)	$105,000	7.90
Odlin Rd and Outer Hammond	Intersection Improvements	37657	$453,000	$0	$453,000	$470,000	$64,000	7.08
Broadway and I-95 SB	Increase Right Turn Pocket Length	14692	$164,000	$0	$164,000	$190,000	$26,000	6.31
Stillwater Ave and I-95	Intersection Improvements	3420	$36,000	$0	$36,000	$690,000	$94,000	0.38
Hogan Rd and I-95 SB off	Intersection Improvements	135	$1,500	$600	$2,100	$300,000	$41,000	0.05
Hogan Rd and I-95 SB on	Intersection Improvements	75885	$814,000	$0	$814,000	$1,300,000	$177,000	4.60
Exit 182 Weaving Sections	Flyover	2685	$22,000	$30,000	$52,000	$30,000,000	$2,610,000	0.02
Exit 182 Weaving Sections	Median lanes	13644	$150,000	$9,000	$159,000	$15,500,000	$1,349,000	0.12
Union Street and I-95 NB	Realign On-Ramp	662	$7,300	$161,000	$168,300	$650,000	$57,000	2.95
Hogan Rd with Full 186 Interchange	New Construction	41595	$446,000	$0	$446,000	$5,000,000	$435,000	1.03
Hogan Rd with Chase Road Interchange	New Construction	40475	$434,000	$0	$434,000	$9,000,000	$783,000	0.55

As Table 5.14 shows, several potential actions would be economically feasible at 2030 traffic levels, but others would not because the safety and mobility benefits would be too small for the cost required for implementation. In the case of auxiliary (accel/decel) lane improvements at ramp junctions, the overall b/c ratio for this strategy was less than 1.00, but some of the individual actions were economically feasible. The most costly actions, the Exit 182 flyover and median lanes options and a new interchange north of Exit 187, all had b/c ratios well below 1.00.

To help with the challenge of setting priorities for future projects, each of the economically feasible actions in Table 5.14 was reanalyzed for base year (2005) traffic conditions. For auxiliary lanes, a selection of four economically feasible accel/decel lane improvements (Exit 182B northbound on-ramp, Exit 184 northbound off-ramp, Exit 185 northbound on-ramp, and Exit 185 southbound on-ramp) were evaluated as a group. The results of the base year analysis are summarized in Table 5.15. An action with a v/c ratio greater than 1.00 for existing traffic conditions, would be a viable candidate to be considered as a near-term improvement, because the annual benefits of the project would offset the annualized costs immediately. An action economically feasible for traffic conditions in 2030, but not for conditions in 2005, could be considered a longer-term improvement to be implemented in a future year within the planning horizon.

Table 5.15 Benefit/Cost at Existing Traffic Volumes

Location	Description	Total Annual Reduction in Delay (vht)	Annual Mobility Benefit	Annual Safety Benefit	Mobility and Safety Benefits	Capital Cost	Annualized Capital Cost	B/C Ratio
Selected Ramp Junctions in Study Area	Increase Deceleration Lane Length	1212	$13,300	$48,000	$61,300	$480,000	$42,000	1.46
Service Patrol Zone (as part of freeway management system)	Incident Response	51560	$146,000	$188,000	$334,000	(operating cost)	$105,000	3.18
Odlin Rd and Outer Hammond	Intersection Improvements	1915	$23,000	$0	$23,000	$470,000	$64,000	0.36
Broadway and I-95 SB	Increase Right Turn Pocket Length	10812	$121,000	$0	$121,000	$190,000	$26,000	4.65
Stillwater Ave and I-95	Intersection Improvements	6671	$71,000	$0	$71,000	$690,000	$94,000	0.76
Hogan Rd and I-95 SB on	Intersection Improvements	19727	$212,000	$0	$212,000	$1,300,000	$143,000	1.48
Union Street and I-95 NB	Realign On-Ramp	0	$7,300	$161,000	$168,300	$650,000	$57,000	2.95

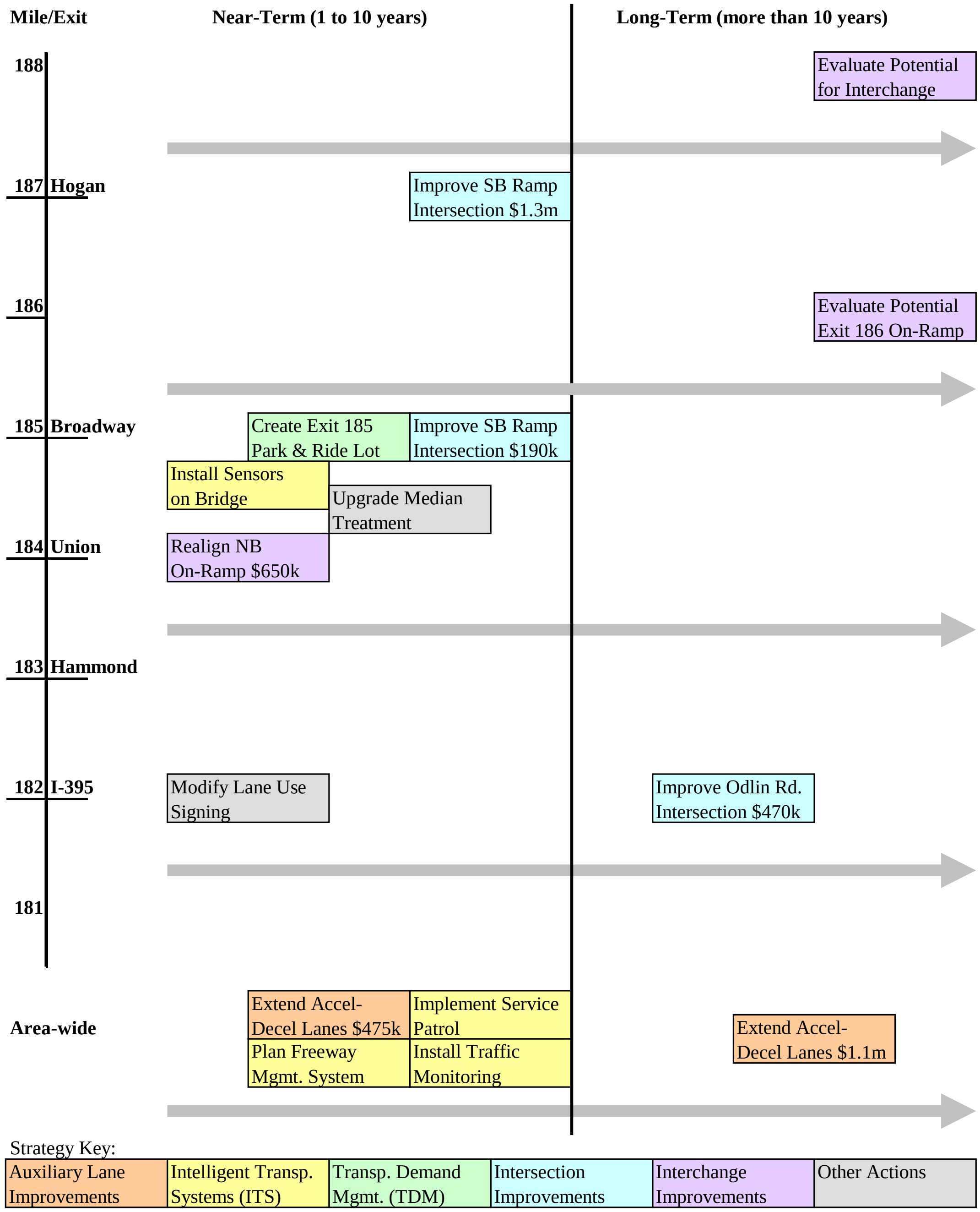
Based on the results shown in Table 5.15, the intersection, the intersection improvements at Odlin Road and at Stillwater Avenue would not have the benefit that other actions would have as near-term candidates. However, most of the actions in Table 5.15 would have benefits that exceed costs at existing traffic levels.

VI Recommendations

The recommendations of the Bangor I-95 Corridor Study are a combination of several complementary strategies aimed to achieve the study purpose of providing safe and efficient transportation service through the year 2030. The near-term recommendations are a blend of specific projects to address the most immediate challenges. These near-term recommendations focus on getting the best operation possible out of the existing highway and making relatively low-cost improvements at specific locations most in need of attention. The long-term recommendations are a blend of improvements to existing infrastructure and evaluations of potential interchange improvements to address the needs of 2030 and beyond. The near-term and long-term recommendations are complementary in scope and are summarized in Figure 6.1.

External factors such as the aging population, new technology, energy costs, truck weights, and the availability of transportation funding weigh heavily on the future of Maine's transportation system. These factors, along with trends in Maine's economy, population, and land development, must be continually monitored to track their direction and anticipate future conditions. Future patterns in these trends will guide future changes in the transportation system and the roles that the various transportation modes play in that system. The recommendations for the I-95 Corridor provide for the needs of the traveling public, and also provide room to adapt to shifting trends and external factors.

Figure 6.1 Bangor I-95 Corridor Study Recommendations



A. Near-Term Improvements

The following pages summarize the near-term improvement recommendations for the Bangor I-95 Corridor Study. These recommendations consist of intelligent transportation systems (ITS), transportation demand management (TDM), interchange, and auxiliary lane improvements to address some of the most problematic locations with reasonably affordable actions. For each of the near-term improvements, the location, problems, recommended action, benefits, challenges, coordination needs, and status are identified.

Near-Term Strategy: **Intelligent Transportation Systems**

Project: Remote Surface State Sensors
City/Town: Bangor
Location: I-95 at Kenduskeag Stream Bridge

Problem: The segment of I-95 between Exits 184 and 185 in Bangor has a high number of single-vehicle lane departure crashes in cold weather due to slippery surfaces.

Recommended Action: Install a set of remote surface state sensors in the vicinity of the bridge to monitor temperature and moisture on the roadway surface. The data from these sensors would alert MaineDOT Maintenance & Operations staff to roadway surface conditions that may lead to crashes and allow staff to respond in a preemptive manner.

Benefits:

- Better surface condition data will allow Maintenance & Operations staff to treat the surface and alert motorists sooner so that the number of crashes caused by slippery conditions is reduced.

Status: Potential candidate project for the Biennial Capital Work Program.

Near-Term Strategy: **Intelligent Transportation Systems**

Project: Interstate Highway Management System
City/Town: Greater Bangor
Location: I-95, I-395

Problem: I-95 in Bangor has the highest Annual Average Daily Traffic volumes of any Maine highway north of Brunswick. While most segments of I-95 operate effectively most of the time, incidents including vehicle crashes, vehicle breakdowns, stalled vehicles, and roadway debris compromise its capacity and safety. Reductions in capacity caused by these incidents result in extreme congestion or major safety hazards, especially during times of high-volume travel or inclement weather. Long backups of traffic have huge costs in terms of delay to users and wasted fuel and greatly increase the threat of crashes.

Recommended Action: In an initial phase that builds on the existing ITS assets in the Greater Bangor area and other locations, begin to develop an Interstate highway management system that continually monitors operating conditions on the Interstate highways, promptly reports incidents to emergency responders, alerts motorists to deteriorated conditions ahead, and provides for the prompt resolution of incidents. Interstate highway management will require systems capable of full-time detection of traffic volume and speed to monitor real-time conditions. The systems and protocols shared by MaineDOT, the Maine State Police, and other entities will need to coordinate decisions, dispatch responders, and inform motorists. The use of these tools should minimize the duration and severity of incidents so that the Interstate highways can perform to the best of their ability. Initial attention should be directed toward the design of an Interstate highway management system, which may extend statewide, to take actions that can be readily implemented to improve coordination and the utilization of existing assets, such as variable message signs. The design of the system should also define a plan for implementation of more extensive traffic monitoring on the highest volume Interstate segments in the Bangor area, communications to the public, and possible implementation of a service patrol for I-95 and I-395 to address incidents.

In a second phase, implement the more extensive actions called for in the system design for improving monitoring capabilities on the highest volume segments of I-95 in the Bangor area, improving communications to the public, and possible implementation of a service patrol.

Benefits:

- Incidents on the Interstate highway system will be detected sooner and be resolved more quickly by responding agencies. This will, in turn, reduce the traffic congestion and safety hazards caused by incidents.
- Motorists will have better information on traffic conditions that lie ahead. They will be able to make better choices about the routes they take to avoided congested areas. By reducing traffic entering congested areas, the highway system will operate more efficiently.

- With detectors to monitor traffic volumes and speeds, the MaineDOT will have better traffic information for monitoring highway operations and for planning to meet future highway needs.

Challenges and Coordination Needs:

- An Interstate highway management system in the Greater Bangor area must be a cooperative effort by MaineDOT, the Maine State Police, local government, and other related services. A control system with protocols for managing information and operations needs to be established.
- An Interstate highway management system must be maintained. New facilities and services such as variable message signs, detection equipment, and service patrols must have sustained sources of funding.

Status: Potential candidate project for the Mid-Range Plan.

Near-Term Strategy: **Auxiliary Lanes**

Project: Auxiliary Lane Improvements at Selected On- and Off-Ramps
City/Town: Bangor
Location: I-95, Exits 182 through 185

Problem: Many on-ramps and off-ramps along I-95 in Bangor have inadequate acceleration and deceleration lanes for existing and future traffic volumes. These lanes are too short to adequately allow vehicles to comfortably accelerate or decelerate between mainline speeds on I-95 and low speeds on the ramps. These ramp conditions result in a reduced level of service and reduced safety for travelers using I-95.

Recommended Action: Make auxiliary lane improvements at selected ramp junctions where the safety and mobility benefits of lengthening acceleration or decelerations make such improvements economically feasible under current traffic conditions. The four recommended improvement locations are at the Exit 182B northbound on-ramp, the Exit 184 northbound off-ramp, the Exit 185 northbound on-ramp, and the Exit 185 southbound on-ramp. The added length of auxiliary lanes will provide adequate acceleration and deceleration lengths between the highway-speed mainline of I-95 and the low-speed ramps. They should be parallel to the mainline through lanes in these high-volume locations.

Benefits:

- Overall levels of service at ramp junctions will be improved.
- Vehicular movements at the improved ramps will be safer. Merge movements at the on-ramps and diverge movements at the off-ramps will be accomplished more smoothly.

Challenges and Coordination Needs:

- Opportunities exist to coordinate these improvements with other near-terrm improvements at Exits 184 and 185.
- Night work should be considered to minimize traffic impacts to I-95 traffic during construction.
- Interstate Maintenance funds can be used for auxiliary lane improvements.

Status: Potential candidate project for the Biennial Capital Work Program.

Near-Term Strategy: **Transportation Demand Management**

Project: Exit 185 Park & Ride Facility
City/Town: Bangor
Location: Vicinity of I-95 Exit 185 (Broadway)

Problem: For users of I-95 and connecting highways, few formal park & ride facilities exist in eastern and northern Maine. Until the past year, only one existed east and north of Pittsfield. The lack of formal park & ride facilities limits the opportunities for travelers to rideshare. Successful park & ride facilities have typically been located near intersection and interchanges used by large numbers of long-distance travelers of arterial highways.

Recommended Action: Establish a formal park & ride facility in the vicinity of Exit 185 in Bangor. This facility may be located in an existing parking lot or a new site, with appropriate signing and amenities.

Benefits:

- I-95 users from the East Side of Bangor will have convenient access to a park & ride facility when traveling to destinations on I-95 and Route 15.
- Users of the park & ride facility will reduce vehicle-miles traveled on I-95 and other routes. This reduction in vehicle-miles will also conserve fuel, reduce traffic delays, and improve highway safety.
- Park & ride users at Exit 185 can be connected to the Bangor Area Transportation (BAT) bus route system, which has two bus routes that serve the Exit 185 area.

Challenges and Coordination Needs:

- The vicinity around Exit 185 has very limited vacant land, but potential sites exist at the parking lots of established businesses.
- Establishing a park & ride facility will require cooperation with affected businesses and property owners.

Status: Unfunded and unscheduled.

Near-Term Strategy: **Intersection Improvements**

Project: Exit 185 South Ramps Intersection Improvement
City/Town: Bangor
Location: I-95, Exit 185 (Broadway)

Problem: The south off-ramp of Exit 185 has inadequate vehicle storage capacity for the off-ramp approach to the signalized Broadway intersection. This results in inefficient traffic flow on the off-ramp approach and leads to excessive intersection delays and traffic queues that create a safety hazard on the southbound off-ramp.

Recommended Action: Extend the length of the right-turn lane on the southbound off-ramp.

Benefits:

- Delays at the Broadway intersection will be reduced.
- Queues of vehicles on the southbound off-ramp will be shortened, and safety at the ramp junction on the I-95 mainline will be improved.

Challenges and Coordination Needs:

- For construction, a traffic maintenance plan will be needed to allow the necessary work to be done while traffic flow is accommodated. Nighttime construction may be a consideration.

Status: Potential candidate project for the Biennial Capital Work Program or the Mid-Range Plan.

Near-Term Strategy: **Intersection Improvements**

Project: Exit 187 South Ramps Intersection Improvement
City/Town: Bangor
Location: I-95, Exit 187 (Hogan Road)

Problem: Hogan Road in the vicinity of Exit 187 experiences poor levels of service during p.m. peak hours. The longest delays occur at the intersection of Hogan Road and Bangor Mall Boulevard and Springer Drive, west of the Exit 187 southbound ramps. Uneven utilization of the southbound and eastbound approaches to the intersection results in excessive delays.

Recommended Action: Modify the eastbound approach to the Exit 187 southbound ramps intersection to provide a through lane, a right-turn lane, and a shared through and right-turn lane. This will increase the number of lanes available for right turns to the southbound on ramp from one to two. In addition, increase the width of the southbound on-ramp to two lanes.

Benefits:

- Delays at the Bangor Mall Boulevard intersection would be reduced. This would improve the level of service from F to E at the Bangor Mall Boulevard intersection.
- At the intersection of Hogan Road and the southbound ramps, delays would be reduced and the level of service would improve.

Challenges and Coordination Needs:

- For construction, a traffic maintenance plan will be needed to allow the necessary work to be done while traffic flow is accommodated. Nighttime construction may be a consideration.

Status: Potential candidate project for the Mid-Range Plan.

Near-Term Strategy: **Interchange Improvements**

Project: Exit 184 Northbound On-Ramp Improvement
City/Town: Bangor
Location: I-95, Exit 184 (Union Street)

Problem: The northbound side of Exit 184 has three high crash location: the ramps intersection with Union Street, the merge point of the northbound on-ramp with the I-95 mainline, and the I-95 mainline upstream of the merge point. At the Union Street intersection, there are an unusually high number of angle crashes involving northbound off-ramp traffic crossing Union Street. A connection from this intersection, using a portion of the northbound on-ramp, to Ohio Street attracts this cross traffic. There are also a high number of rear-end crashes at or near the on-ramp merge point. At the merge point, the on-ramp acceleration lane is too short, and the adjacent cemetery and downstream bridge (over the Kenduskeag Stream) prevents extension of the acceleration lane northward.

Recommended Action: Reconstruct the northbound on-ramp to provide a shorter ramp and a longer acceleration lane. Close the roadway connecting the on-ramp with Ohio Street.

Benefits:

- The realigned northbound on-ramp will address two high crash locations at the merge point of the ramp.
- The realigned northbound on-ramp will lengthen the acceleration lane by 400 feet.
- Closure of the Ohio Street connection from the northbound ramps will eliminate a major source of crashes at the Union Street intersection.

Challenges and Coordination Needs:

- Construction of the improvement will require maintenance of traffic in an area where the median is very narrow.
- Bridge replacement projects for Union Street and Ohio Street bridges over I-95 are in the design process for construction within the next five years. Opportunity exists to coordinate the northbound on-ramp improvement with the two bridge replacement projects.

Status: Available high-priority funding for Exit 184 may be used for this improvement action.

Near-Term Strategy: **Other Actions**

Project: Modify Lane Use Signing
City/Town: Bangor
Location: I-95 Mainline

Problem: A high proportion of the traffic on I-95 in Bangor is locally generated traffic using the on- and off-ramps of the Bangor interchanges. Longer-distance travelers who would normally travel in the right lane through low-volume rural areas encounter conflicts with local traffic entering from and exiting to the interchange ramps on high-volume I-95 in Bangor. These conflicts contribute to the crashes and other operational problems experienced by motorists traveling through Bangor. Existing “Keep Right Except to Pass” signs on the I-95 approaches to Bangor encourage travelers use the right lane.

Recommended Action: As an initial step, remove the “Keep Right Except to Pass” signs located in Bangor (northbound approach) and Orono (southbound approach). As a further action, modify existing overhead signing to encourage use of the left lane by non-ramp traffic, particularly on the northbound and southbound approaches to Exit 182, where ramp traffic is more than two thirds of total traffic.

Benefits:

- Sign modifications should reduce the overuse of the right lane of I-95 through Bangor and reduce operational problems near interchange ramps.

Status: The Regional Traffic Engineer is planning to remove the “Keep Right Except to Pass” signs.

Near-Term Strategy: **Other Actions**

Project: Median Safety Improvement
City/Town: Bangor
Location: I-95, between Exit 183 and Exit 186

Problem: A two-mile portion of I-95 in Bangor, between Exits 183 and 186, has some of the narrowest median widths on the Interstate System in Maine. For most of this portion, the median between the northbound and southbound traveled ways is 16 feet or 10 feet in width. Using W-beam guardrail and glare foils to protect motorists, this stretch of I-95 requires frequent attention by highway maintenance crews to maintain the functionality of these safety features. The high need for maintenance attention exposes workers to high-volume, high-speed traffic conditions and results in high labor and materials maintenance costs.

Recommended Action: As part of a statewide review of Interstate medians, evaluate the best overall median treatment for this portion of I-95, in terms of effectiveness, cost, and maintenance effort. Potential treatments include upgraded conventional guardrail, cable guardrail, thrie beam guardrail, and concrete barrier. Implement the recommended treatment.

Benefits:

- The I-95 median in Bangor will have a modernized median that will provide protection for motorists and maintenance staff at a reasonable cost.

Challenges and Coordination Needs:

- Improvements to the I-95 median in Bangor will need to be prioritized with other median improvements statewide.
- Bridge replacement projects for Union Street and Ohio Street bridges over I-95 are in the design process for construction within the next five years. Opportunity exists to coordinate the median improvement with the two bridge replacement projects.

Status: A statewide review of Interstate medians in progress.

B. Long-Term Improvements

The long-term improvements to the I-95 Corridor draw from each of the auxiliary lane, intersection improvement, and interchange improvement strategies. As with the near-term improvements, the location, problems, recommended action, benefits, challenges, coordination needs, and status of the long-term improvements are identified. Monitoring of I-95 conditions, near-term improvement effectiveness, and external trends will be necessary to determine if adjustments to the long-term recommendations are needed.

Long-Term Strategy: Intersection Improvements

Project: Odlin Road Intersection Improvement
City/Town: Bangor
Location: Off I-95, Exit 182 (I-395)

Problem: Analysis of future conditions shows that traffic queues at the intersection of Odlin Road and Outer Hammond Street, west of Exit 182, will exceed the available storage lane lengths, particularly on the eastbound and southbound approaches. Queues that are too long for the available storage lanes reduce the capacity and efficiency of the intersection.

Recommended Action: Construct a second southbound left-turn lane and lengthen the eastbound left turn lane.

Benefits:

- Queues and delays at the intersection will be shortened.

Challenges and Coordination Needs:

- Some additional right-of-way along Odlin Road may be needed.
- For construction, a traffic maintenance plan will be needed to allow the necessary work to be done while traffic flow is accommodated. Nighttime construction may be a consideration.

Status: Potential candidate project for the Mid-Range Plan.

Long-Term Strategy: **Auxiliary Lanes**

Project: Auxiliary Lanes at On- and Off-Ramps
City/Town: Bangor
Location: I-95, Exits 182 through 187

Problem: Many on-ramps and off-ramps along I-95 in Bangor have inadequate acceleration and deceleration lanes for existing and future traffic volumes. These lanes are too short to adequately allow vehicles to comfortably accelerate or decelerate between mainline speeds on I-95 and low speeds on the ramps. These ramp conditions result in a reduced level of service and reduced safety for travelers using I-95.

Recommended Action: As parts of future projects along I-95, upgrade the ramp junctions from Exit 182 to Exit 187 not addressed in near-term improvements to provide adequate acceleration and deceleration lengths between the highway-speed mainline of I-95 and the low-speed ramps. The added length of auxiliary lanes should be parallel to the mainline through lanes in these high-volume locations. The ramps in need of these improvements are shown in Figure 4.1.

Benefits:

- Overall levels of service at ramp junctions will be improved.
- Vehicular movements at the improved ramps will be safer. Merge movements at the on-ramps and diverge movements at the off-ramps will be accomplished more smoothly.

Challenges and Coordination Needs:

- Priorities should be set to ensure that auxiliary lane improvements are programmed in at the appropriate times. Factors that could assist in the prioritization include up-to-date traffic volumes, recent crash history, the magnitude of geometric deficiencies, and the ability to coordinate with other I-95 projects such as resurfacing, hazard elimination, and bridge projects. It is expected that many improvement locations could be addressed at the same times as future resurfacing projects.
- Night work should be considered to minimize traffic impacts to I-95 traffic during construction.
- Interstate Maintenance funds can be used for auxiliary lane improvements.

Status: Potential candidate project for the Mid-Range Plan.

Long-Term Strategy: Interchange Improvements

Project: Exit 187 Access Improvement Feasibility Study
City/Town: Bangor
Location: I-95, Exit 187 and surrounding area

Problem: Exit 187 remains a heavily used interchange on I-95 due to the commercial attractions of the Hogan Road area, anchored by the Bangor Mall and other retail developments. Near-term improvements can be implemented to reduce existing and future traffic congestion in the Hogan Road area, but future development in the area could lead to a reoccurrence of traffic congestion that the area has experienced in the past. Major interchange improvements are not an economically feasible solution at the present time.

Recommended Action: In the long term, the need for major interchange improvements may need to be revisited. Potential options to consider may include the improvement of the existing Exit 187 interchange, addition of a northbound on-ramp from Exit 186, construction of a new interchange north of Exit 187, or multimodal transportation improvements. The options to consider will depend, in part, on the future patterns of development in the area, energy costs, and other factors.

Benefits:

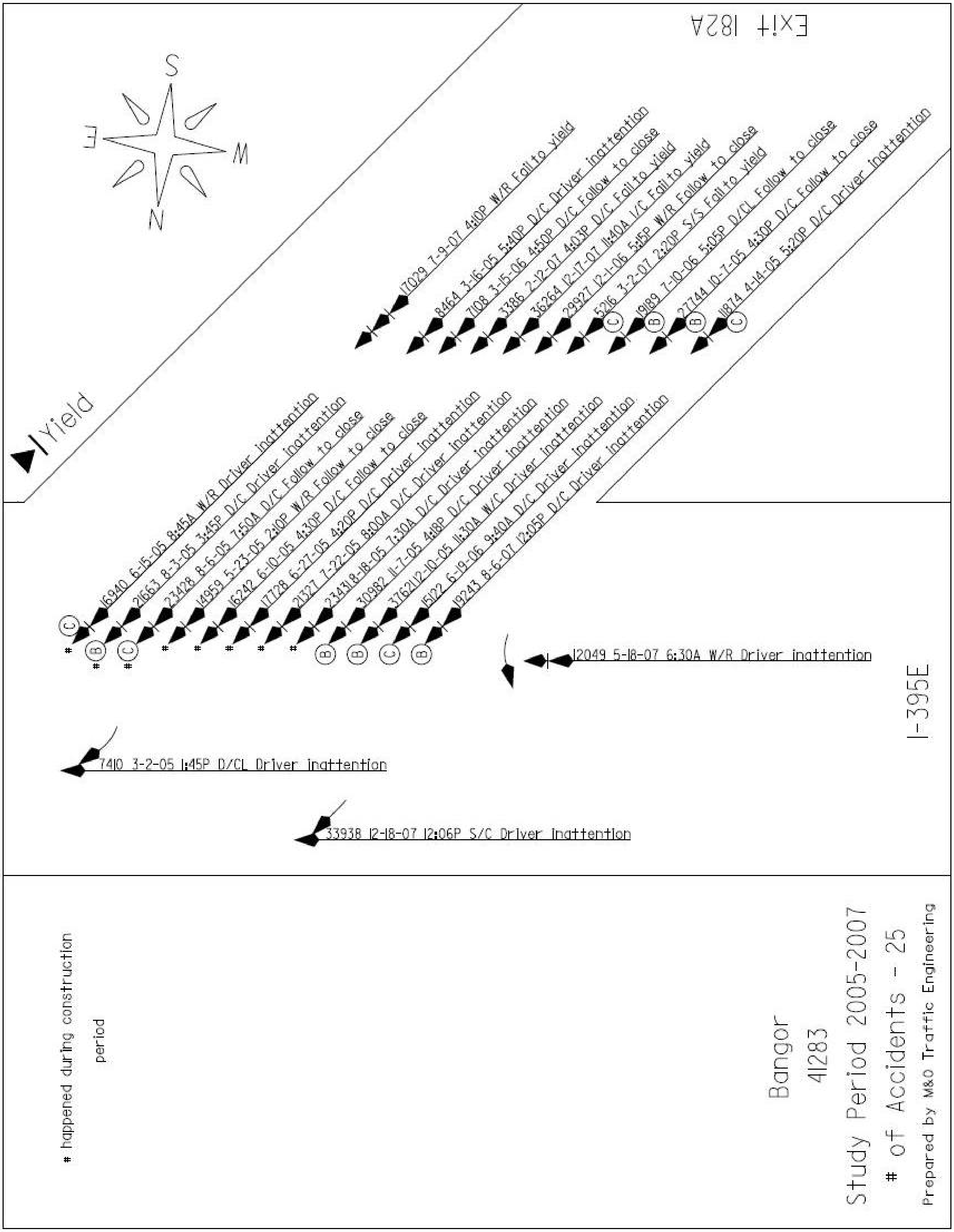
- A study outcome that will identify a feasible course of action(s) that will maintain or improve I-95 accessibility to the Hogan Road commercial area with safety and adequate mobility.

Challenges and Coordination Needs:

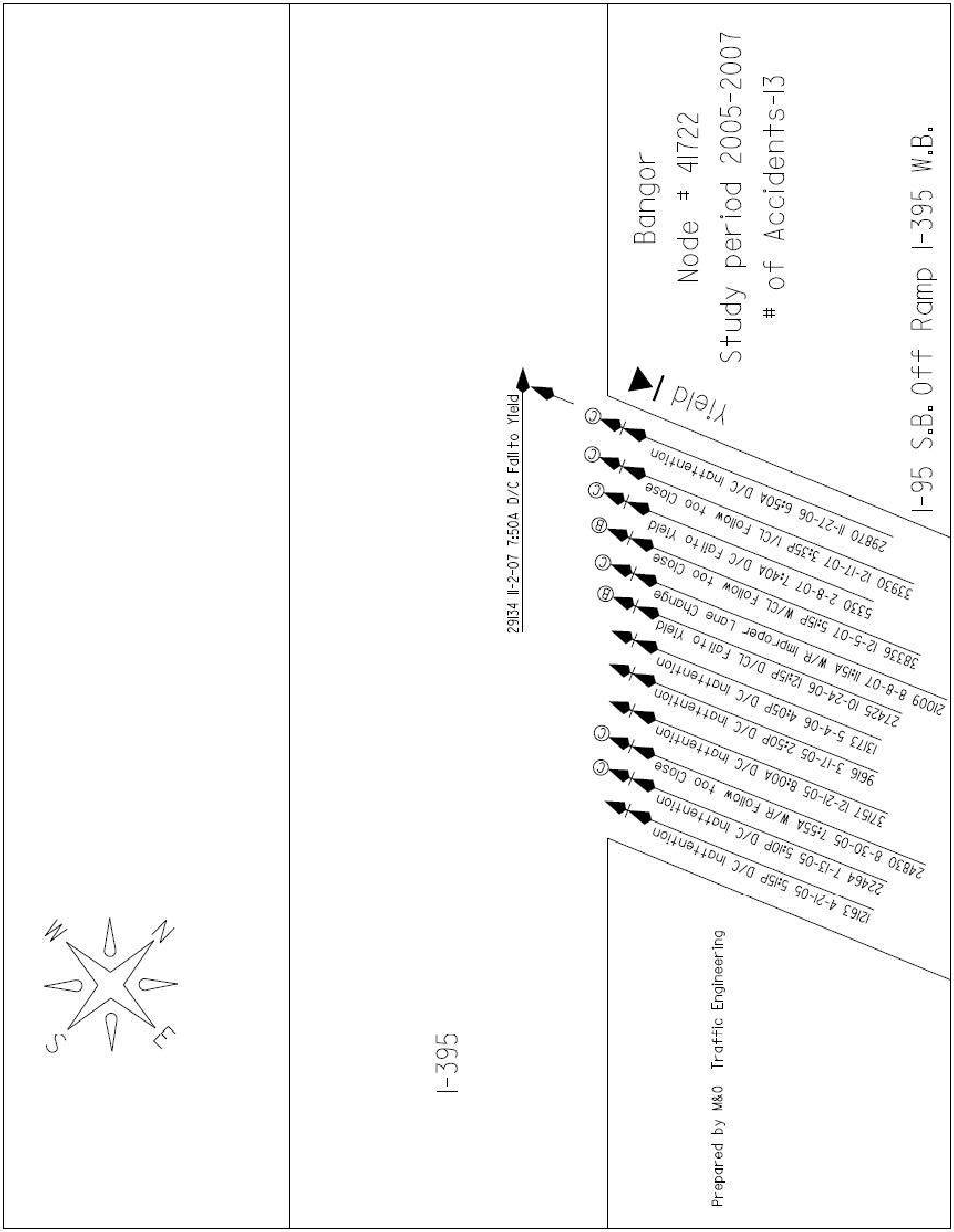
- Land use patterns and site design features of future developments will affect future mobility and safety in the Hogan Road area.
- Any consideration of major changes to an existing interchange or a new interchange will require the identification of issues affecting the natural and man-made environments. A feasibility study that advances such major changes will lead to a further assessment of environmental impacts through the decisionmaking process of NEPA (the National Environmental Policy Act) and STPA (Maine's Sensible Transportation Policy Act).

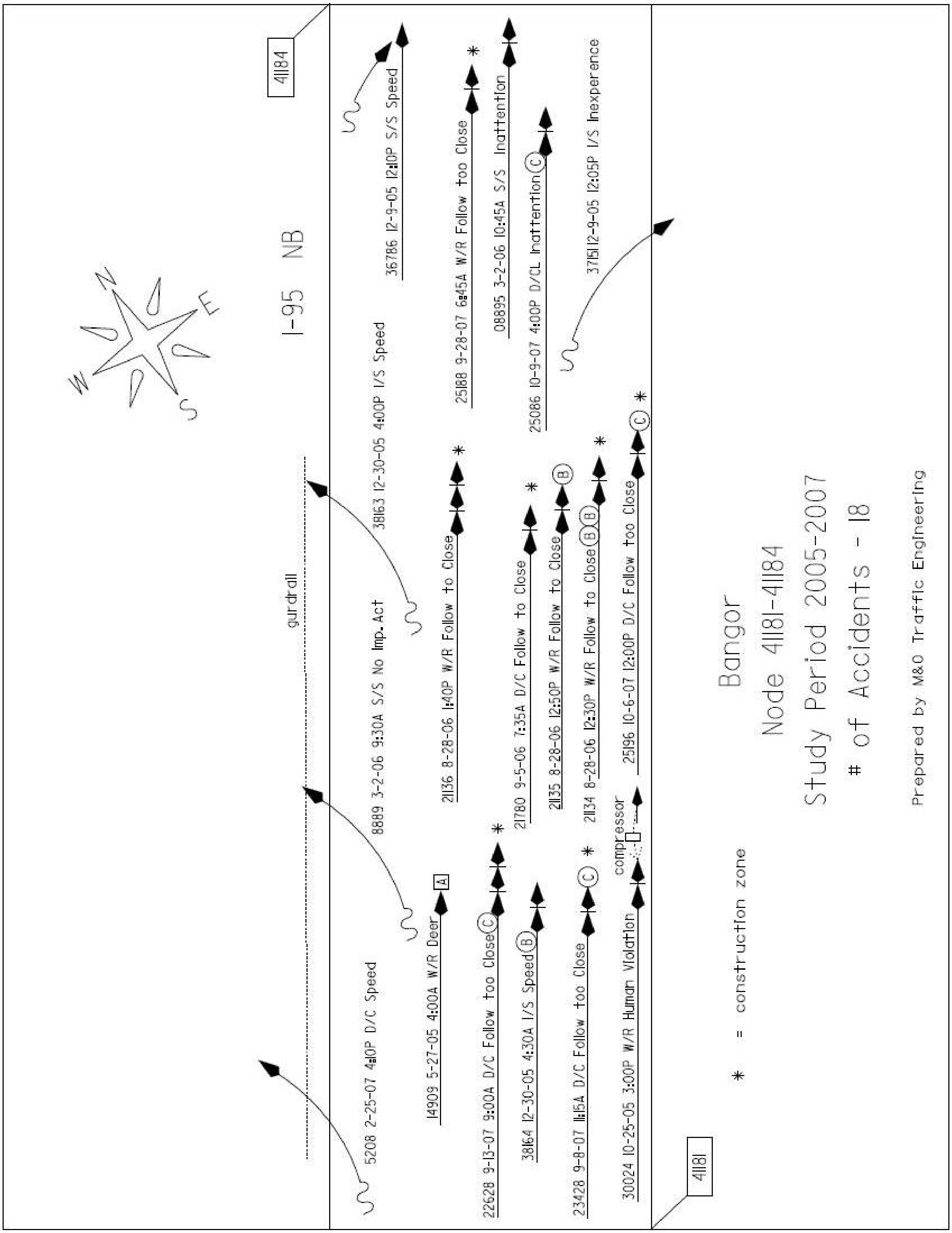
Status: Unfunded and Unscheduled.

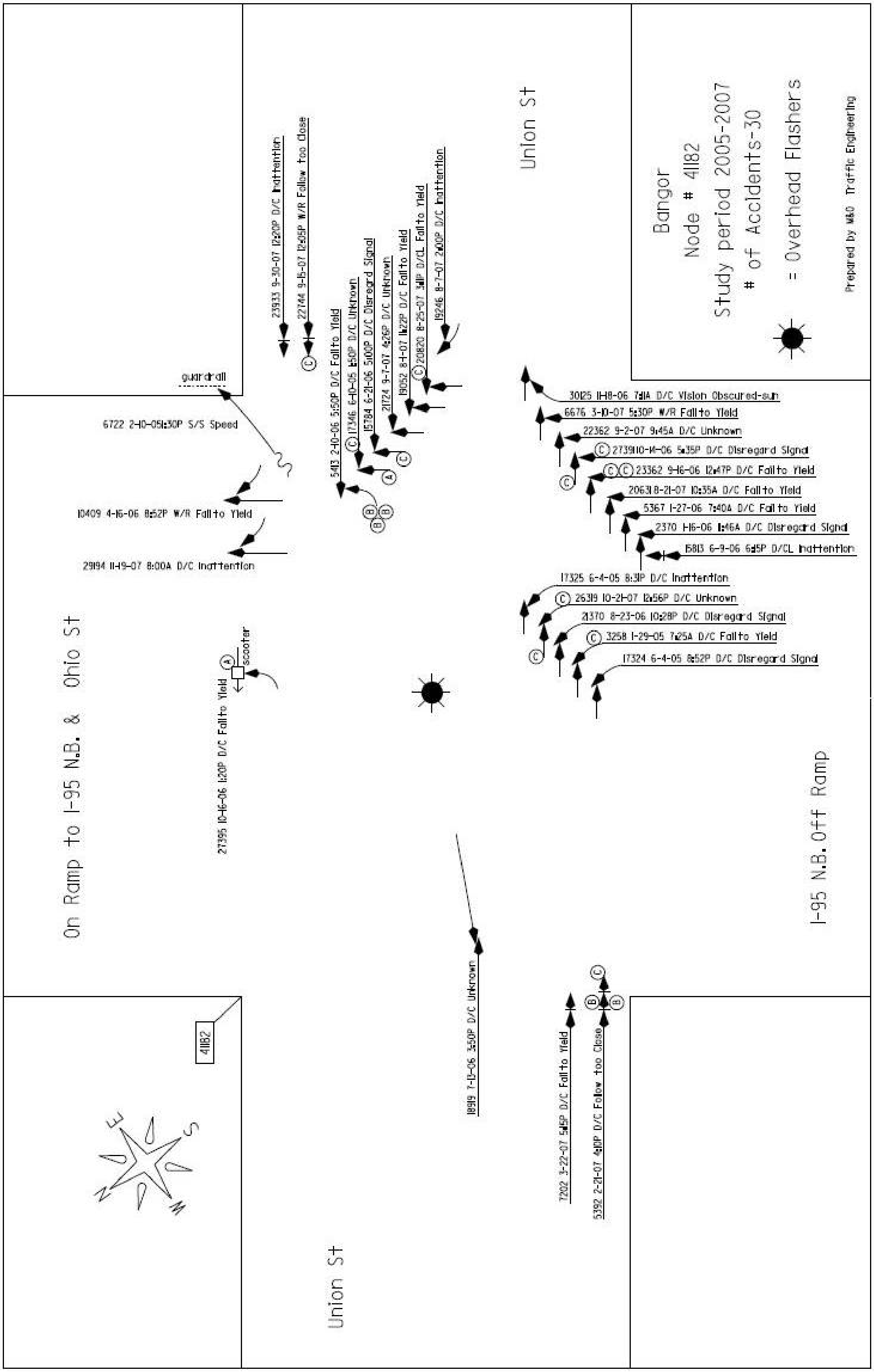
Appendices

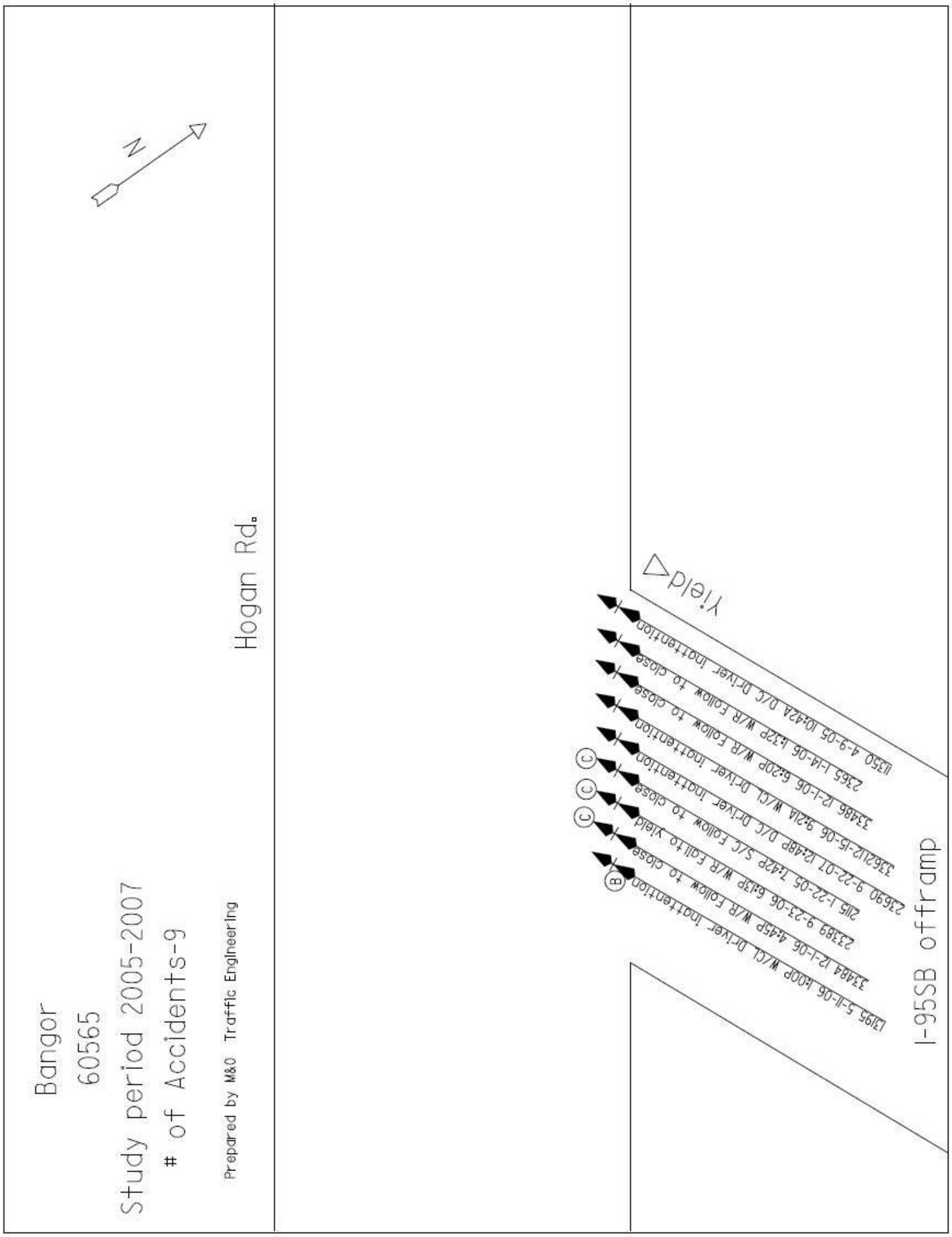


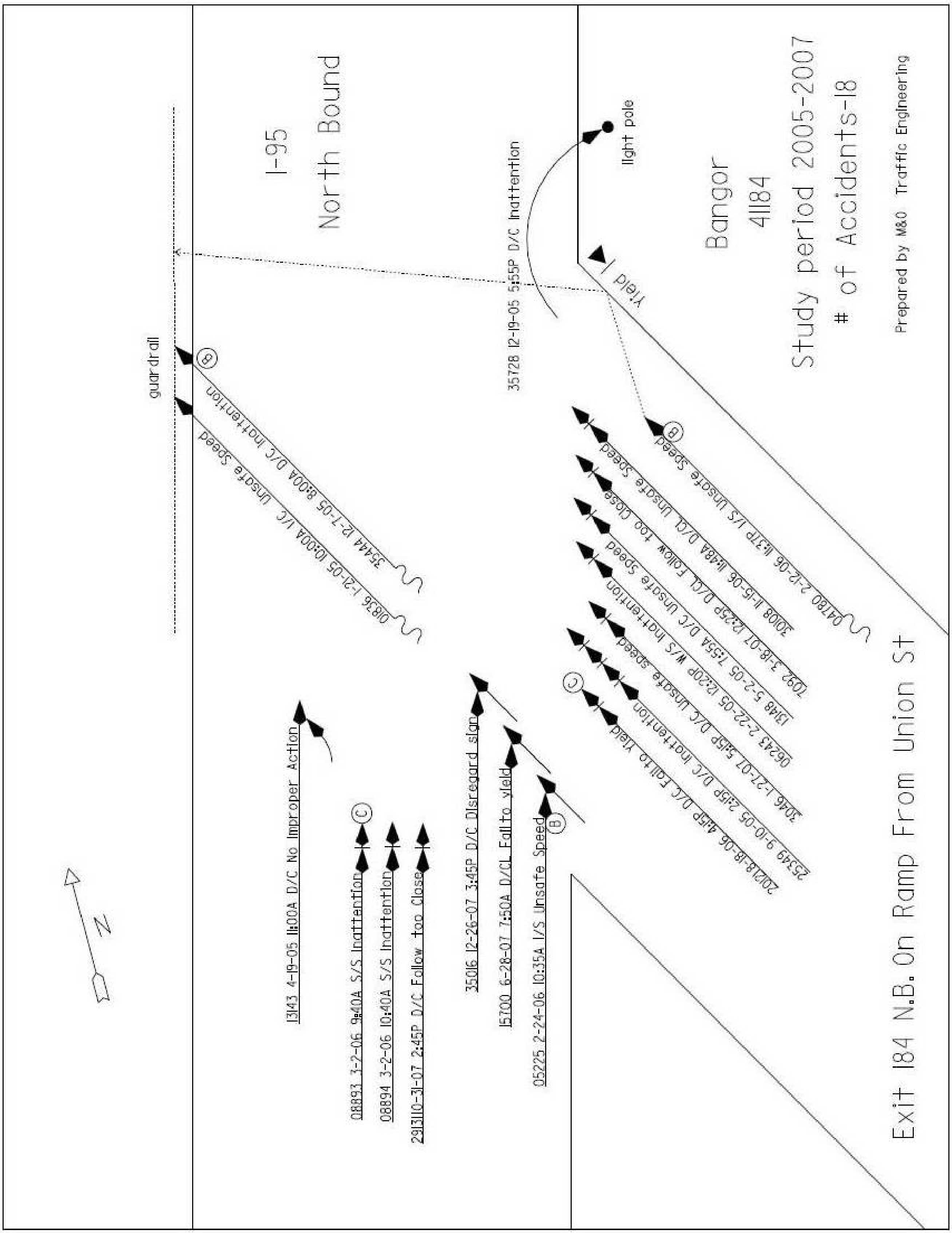
Exit 182A
S
E
W
N
Yield
17029 7-9-07 4:10P W/R Fail to yield
8464 3-16-05 5:40P D/C Driver inattention
7108 3-15-06 4:50P D/C Follow to close
3386 2-12-07 4:03P D/C Fail to yield
36264 12-17-07 11:40A I/C Fail to yield
29927 12-1-06 5:15P W/R Follow to close
5216 3-2-07 2:20P S/S Fail to yield
19189 7-10-06 5:05P D/CL Follow to close
27744 10-7-05 4:30P D/C Follow to close
11874 4-14-05 5:20P D/C Driver inattention
16940 6-15-05 8:45A W/R Driver inattention
21663 8-3-05 3:45P D/C Driver inattention
23428 8-6-05 7:50A D/C Follow to close
14959 5-23-05 2:10P W/R Follow to close
16242 6-10-05 4:30P D/C Follow to close
17728 6-27-05 4:20P D/C Driver inattention
21327 7-22-05 8:00A D/C Driver inattention
23431 8-18-05 7:30A D/C Driver inattention
30982 11-7-05 4:18P D/C Driver inattention
37621 12-10-05 11:30A W/C Driver inattention
15122 6-19-06 9:40A D/C Driver inattention
19243 8-6-07 12:05P D/C Driver inattention
12049 5-18-07 6:30A W/R Driver inattention
I-395E
7410 3-2-05 1:45P D/CL Driver inattention
33938 12-18-07 12:06P S/C Driver Inattention
happened during construction period
Bangor
41283
Study Period 2005-2007
# of Accidents - 25
Prepared by M&O Traffic Engineering

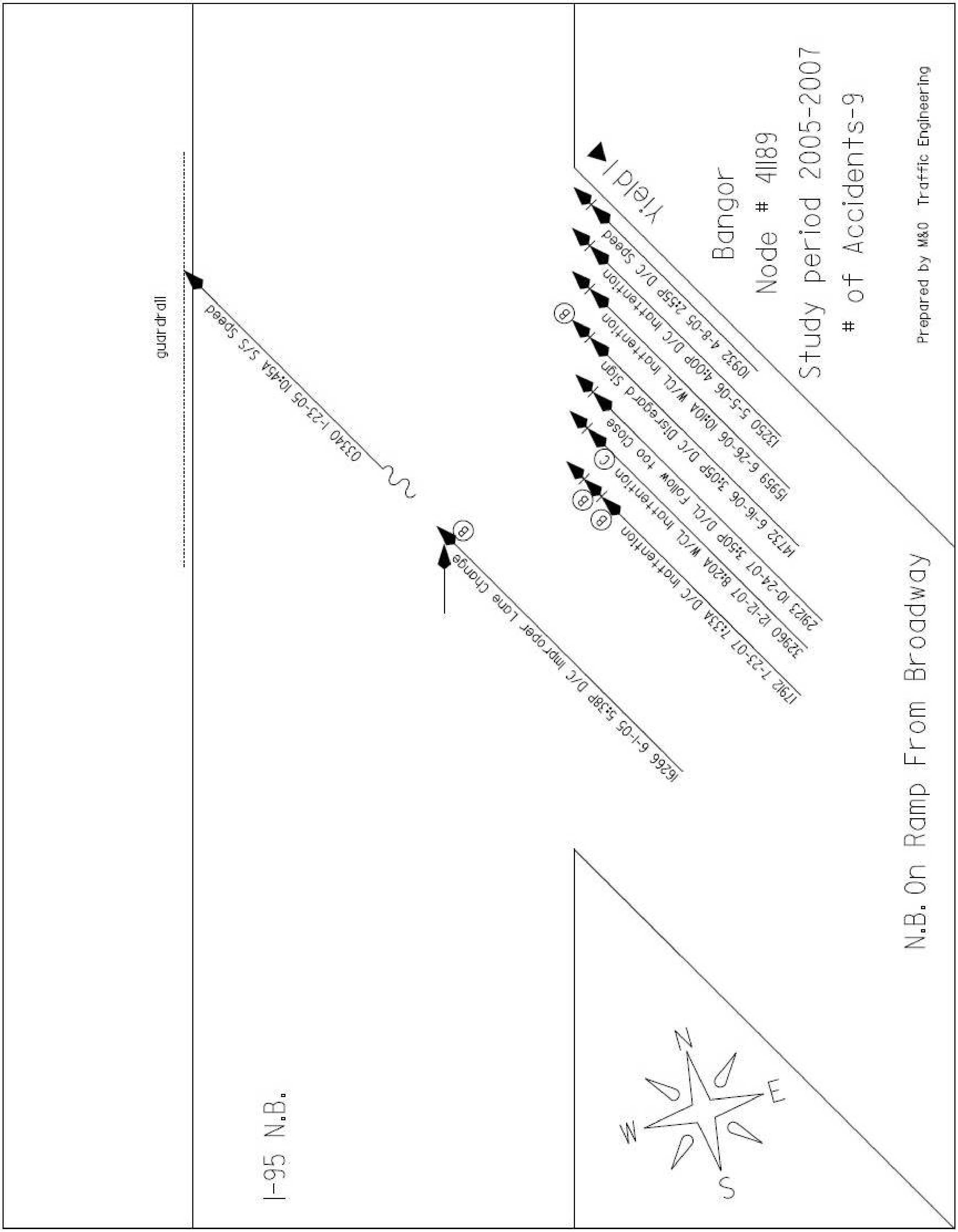

Bangor
Node # 41722
Study period 2005-2007
# of Accidents-13
I-95 S.B. Off Ramp I-395 W.B.
Yield
29134 11-2-07 7:50A D/C Fail to Yield
29870 11-27-06 6:50A D/C Inattention
33930 12-17-07 3:35P I/CL Follow too Close
5330 2-8-07 7:40A D/C Fail to Yield
38336 12-5-07 5:15P W/CL Follow too Close
21009 8-8-07 11:15A W/R Improper Lane Change
27425 10-24-06 12:15P D/CL Fail to Yield
13173 5-4-06 4:05P D/C Inattention
9616 3-17-05 2:50P D/C Inattention
37157 12-21-05 8:00A D/C Inattention
24830 8-30-05 7:55A W/R Follow too Close
22464 7-13-05 5:10P D/C Inattention
12163 4-21-05 5:15P D/C Inattention
I-395
Prepared by M&O Traffic Engineering
N
E
S
W

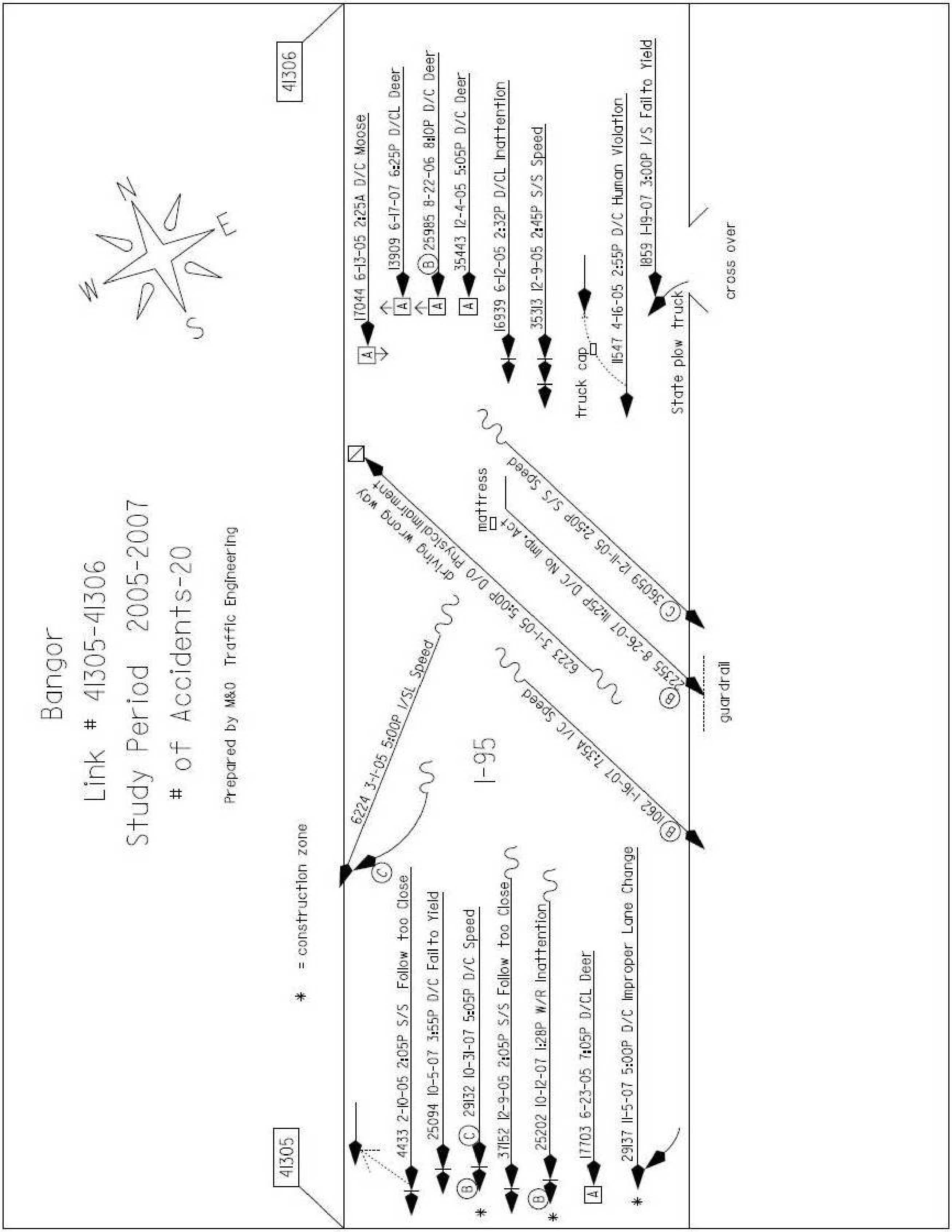

41184
I-95 NB
N
E
S
W
gurdrail
36786 12-9-05 12:10P S/S Speed
38163 12-30-05 4:00P I/S Speed
25188 9-28-07 6:45A W/R Follow too Close
08895 3-2-06 10:45A S/S Inattention
25086 10-9-07 4:00P D/CL Inattention
37151 12-9-05 12:05P I/S Inexperence
8889 3-2-06 9:30A S/S No Imp.Act
21136 8-28-06 1:40P W/R Follow to Close
21780 9-5-06 7:35A D/C Follow to Close
21135 8-28-06 12:50P W/R Follow to Close
21134 8-28-06 12:30P W/R Follow to Close
25196 10-6-07 12:00P D/C Follow too Close
5208 2-25-07 4:10P D/C Speed
14909 5-27-05 4:00A W/R Deer
22628 9-13-07 9:00A D/C Follow too Close
38164 12-30-05 4:30A I/S Speed
23428 9-8-07 11:15A D/C Follow too Close
30024 10-25-05 3:00P W/R Human Violation
compressor
41181
* = construction zone
Bangor
Node 41181-41184
Study Period 2005-2007
# of Accidents - 18
Prepared by M&O Traffic Engineering

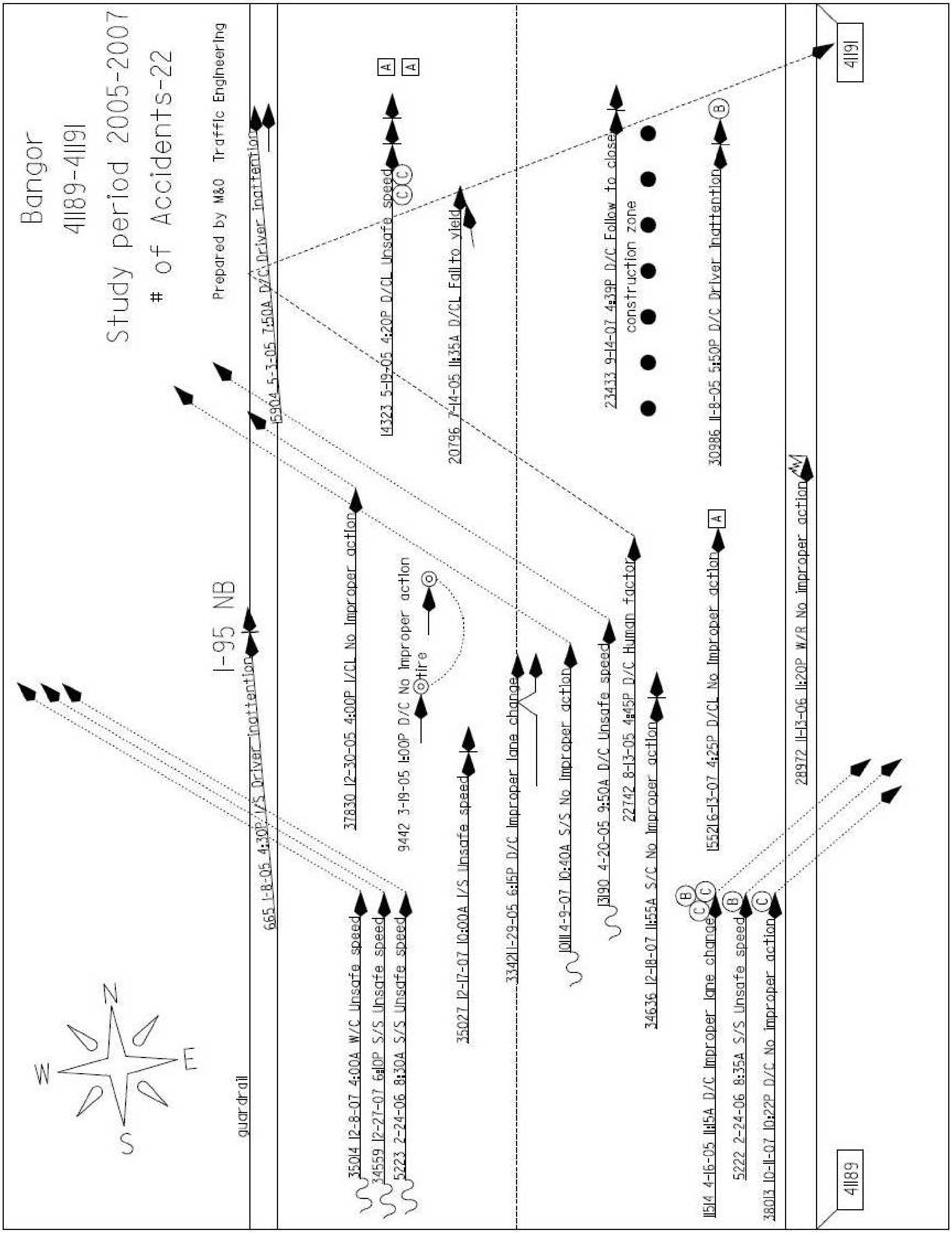

Bangor
Node # 41182
Study period 2005-2007
# of Accidents-30
= Overhead Flashers
Prepared by M&O Traffic Engineering
Union St
On Ramp to I-95 N.B. & Ohio St
I-95 N.B. Off Ramp
Union St
41182

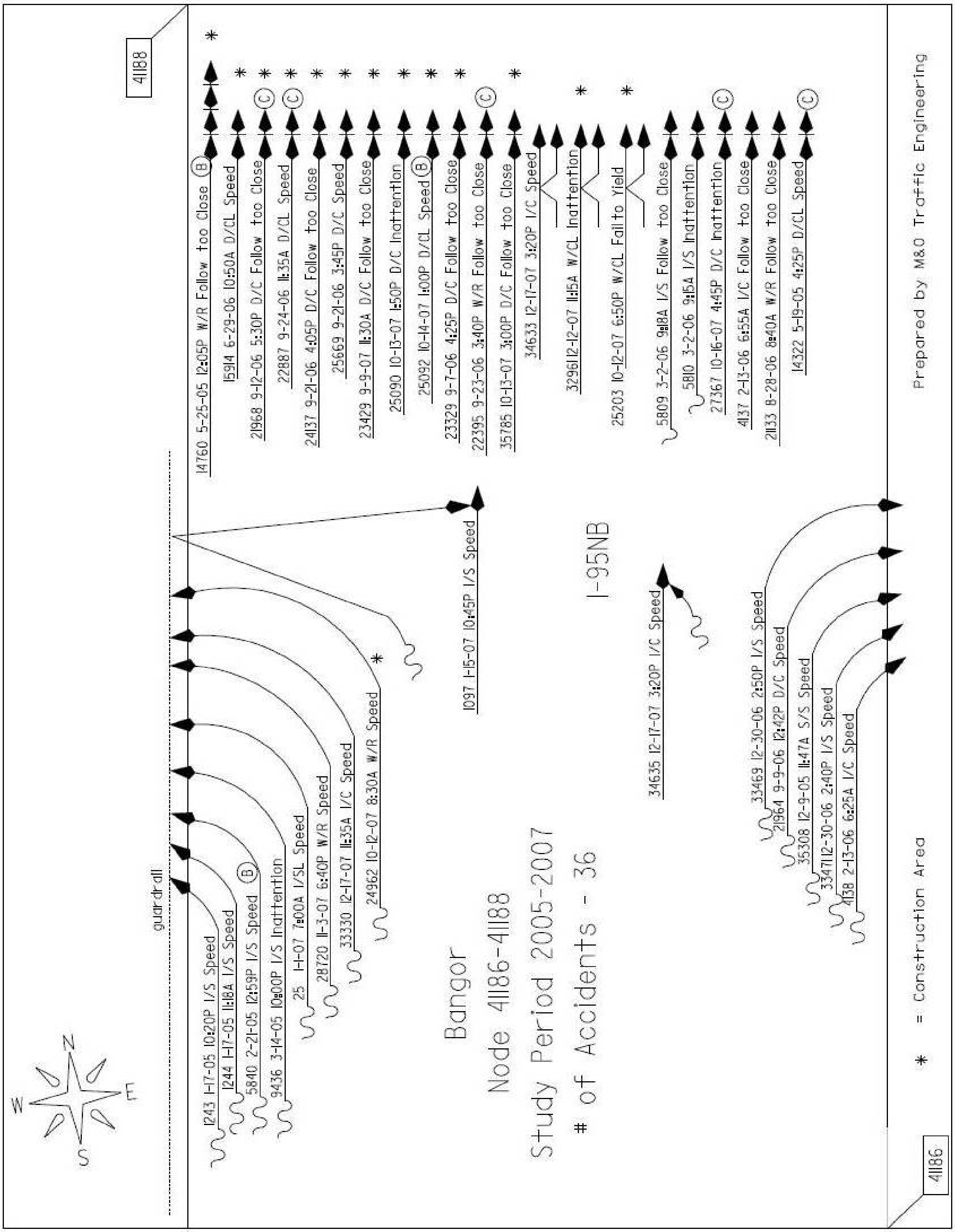

Bangor
60565
Study period 2005-2007
# of Accidents-9
Prepared by M&O Traffic Engineering
N
Hogan Rd.
Yield
11350 4-9-05 10:42A D/C Driver inattention
2365 1-14-06 1:32P W/R Follow to close
33486 12-1-06 6:20P W/R Follow to close
33621 12-15-06 9:21A W/CL Driver inattention
23690 9-22-07 12:48P D/C Driver inattention
2115 1-22-05 7:42P S/C Follow to close
23389 9-23-06 6:13P W/R Fail to yield
33484 12-1-06 4:45P W/R Follow to close
13195 5-11-06 1:00P W/CL Driver inattention
C
C
C
B
I-95SB offramp

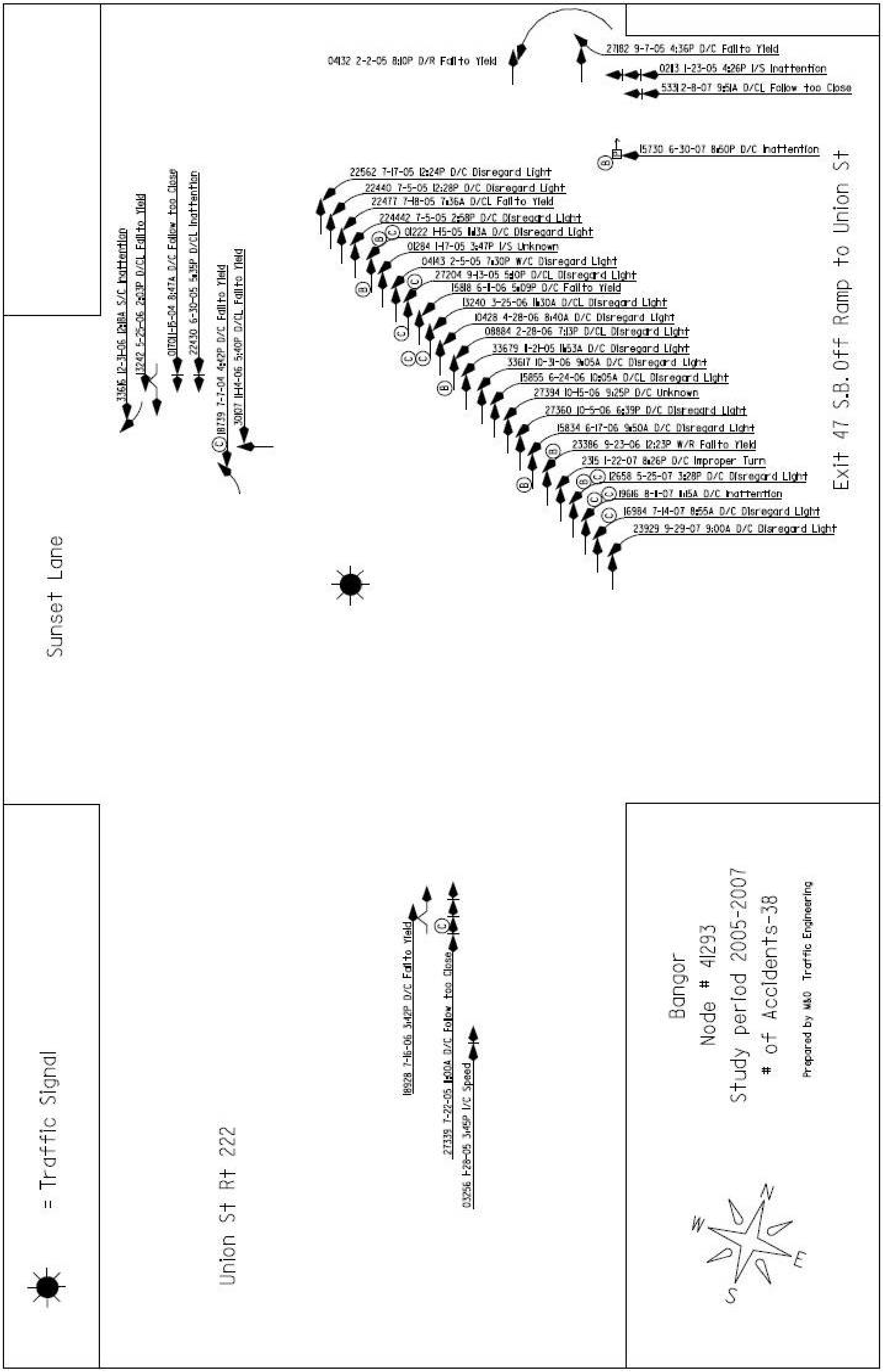

I-95
North Bound
Bangor
41184
Study period 2005-2007
# of Accidents-18
Prepared by M&O Traffic Engineering
Exit 184 N.B. On Ramp From Union St
guardrail
light pole
Yield
35728 12-19-05 5:55P D/C Inattention
35444 12-7-05 8:00A D/C Inattention
01836 1-21-05 10:00A I/C Unsafe Speed
04780 2-12-06 11:37P I/S Unsafe Speed
30108 11-15-06 11:48A D/CL Unsafe Speed
1092 3-18-07 12:25P D/CL Follow too Close
13148 5-2-05 7:55A D/C Unsafe Speed
06243 2-22-05 12:20P W/S Inattention
3046 1-27-07 5:15P D/C Unsafe Speed
25349 9-10-05 2:15P D/C Inattention
20121 8-18-06 4:15P D/C Fail to Yield
13143 4-19-05 11:00A D/C No Improper Action
08893 3-2-06 9:40A S/S Inattention
08894 3-2-06 10:40A S/S Inattention
29131 10-31-07 2:45P D/C Follow too Close
35016 12-26-07 3:45P D/C Disregard sign
15700 6-28-07 7:50A D/CL Fail to yield
05225 2-24-06 10:35A I/S Unsafe Speed
B
C
N

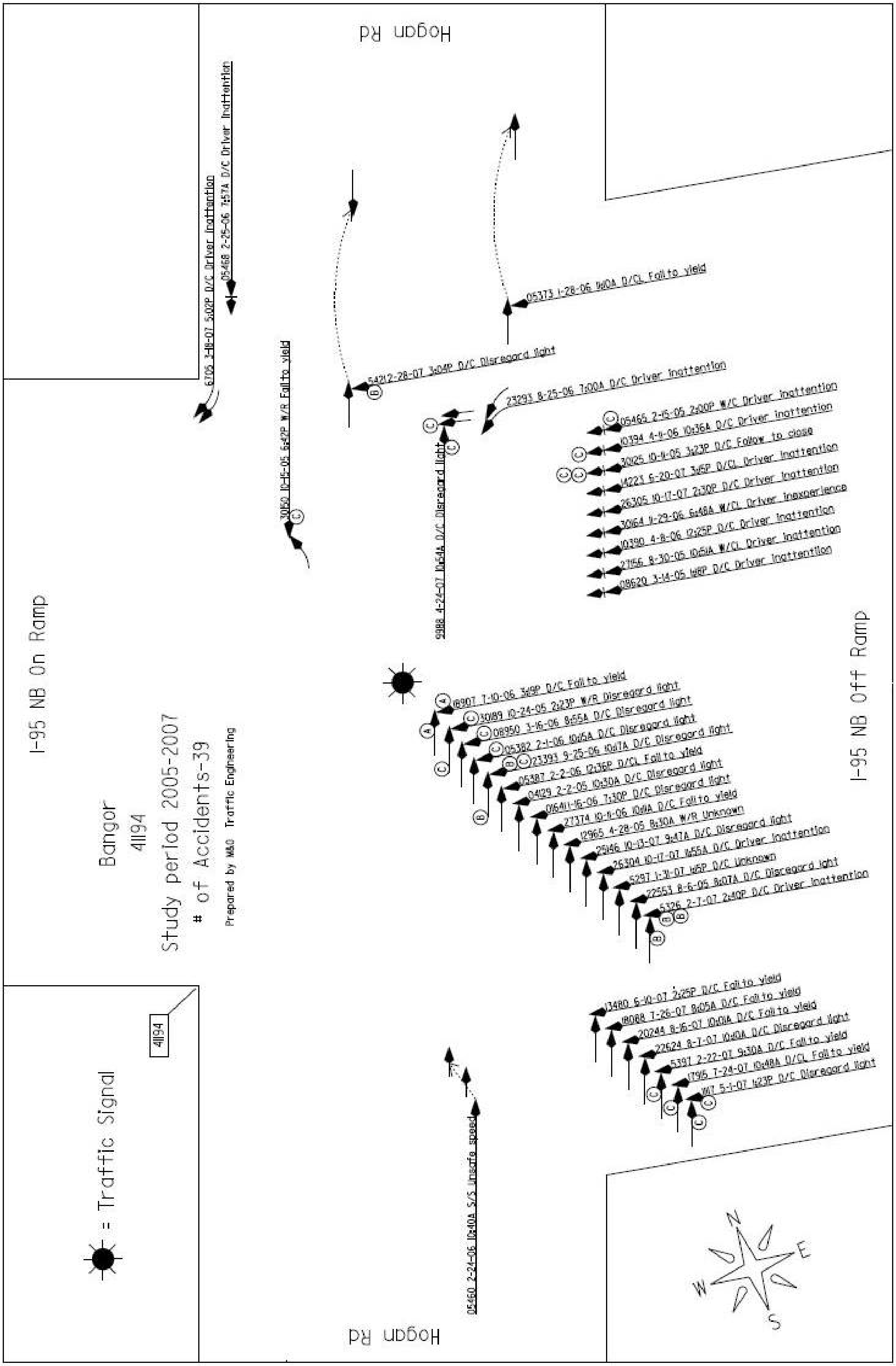

Bangor
Node # 41189
Study period 2005-2007
# of Accidents-9
Prepared by M&O Traffic Engineering
Yield
10932 4-8-05 2:55P D/C Speed
13250 5-5-06 4:00P D/C Inattention
15959 6-26-06 10:10A W/CL Inattention
14732 6-16-06 3:05P D/C Disregard Sign
29123 10-24-07 3:50P D/CL Follow too Close
32960 12-12-07 8:20A W/CL Inattention
17912 1-23-07 7:33A D/C Inattention
16266 6-1-05 5:38P D/C Improper Lane Change
03340 1-23-05 10:45A S/S Speed
B
C
guardrail
N.B. On Ramp From Broadway
I-95 N.B.
N
E
S
W

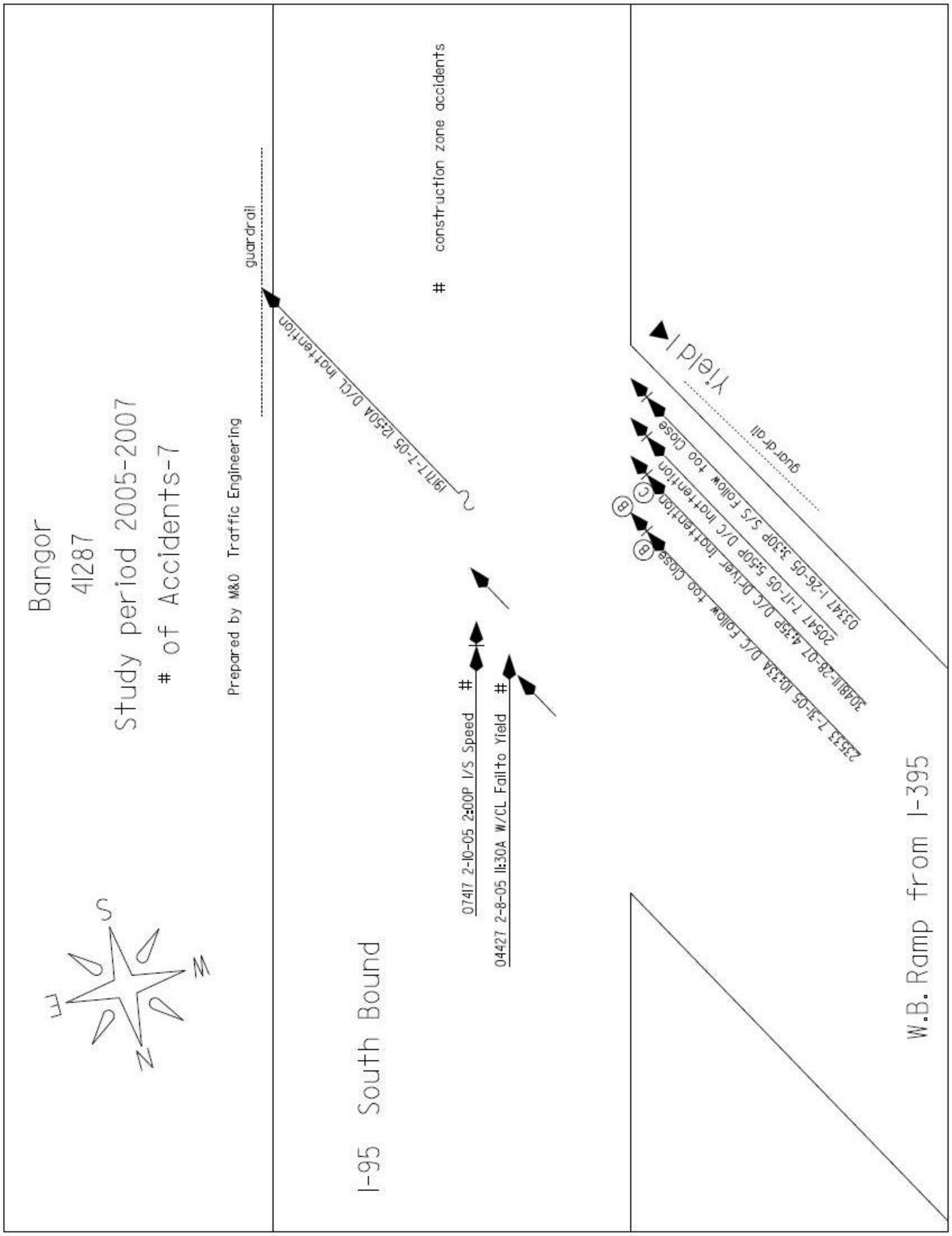

Bangor
Link # 41305-41306
Study Period 2005-2007
# of Accidents-20
Prepared by M&O Traffic Engineering
* = construction zone
41305
41306
N
E
S
W
I-95
17044 6-13-05 2:25A D/C Moose
13909 6-17-07 6:25P D/CL Deer
25985 8-22-06 8:10P D/C Deer
35443 12-4-05 5:05P D/C Deer
16939 6-12-05 2:32P D/CL Inattention
35313 12-9-05 2:45P S/S Speed
truck cap
11547 4-16-05 2:55P D/C Human Violation
1859 1-19-07 3:00P I/S Fail to Yield
State plow truck
cross over
36059 12-11-05 2:50P S/S Speed
mattress
2355 8-26-07 11:25P D/C No Imp. Act
6223 3-1-05 5:00P D/O Physical Impairment
driving wrong way
guardrail
6224 3-1-05 5:00P I/SL Speed
1062 1-16-07 7:35A I/C Speed
4433 2-10-05 2:05P S/S Follow too Close
25094 10-5-07 3:55P D/C Fail to Yield
29132 10-31-07 5:05P D/C Speed
37152 12-9-05 2:05P S/S Follow too Close
25202 10-12-07 1:28P W/R Inattention
17703 6-23-05 7:05P D/CL Deer
29137 11-5-07 5:00P D/C Improper Lane Change


Bangor
41189-41191
Study period 2005-2007
# of Accidents-22
Prepared by M&O Traffic Engineering
I-95 NB
guardrail
N
E
S
W
35014 12-8-07 4:00A W/C Unsafe speed
34559 12-27-07 6:10P S/S Unsafe speed
5223 2-24-06 8:30A S/S Unsafe speed
665 1-8-05 4:30P I/S Driver inattention
5904 5-3-05 7:50A D/C Driver inattention
37830 12-30-05 4:00P I/CL No improper action
9442 3-19-05 1:00P D/C No improper action
tire
14323 5-19-05 4:20P D/CL Unsafe speed
35027 12-17-07 10:00A I/S Unsafe speed
20796 7-14-05 11:35A D/CL Fail to yield
33421 1-29-05 6:15P D/C Improper lane change
10111 4-9-07 10:40A S/S No improper action
13190 4-20-05 9:50A D/C Unsafe speed
22742 8-13-05 4:45P D/C Human factor
23433 9-14-07 4:39P D/C Follow to close
construction zone
34636 12-18-07 11:55A S/C No improper action
11514 4-16-05 11:15A D/C Improper lane change
5222 2-24-06 8:35A S/S Unsafe speed
38013 10-11-07 10:22P D/C No improper action
15521 6-13-07 4:25P D/CL No improper action
30986 11-8-05 5:50P D/C Driver inattention
28972 11-13-06 1:20P W/R No improper action
41189
41191


41188
41186
guardrail
N
S
E
W
Bangor
Node 41186-41188
Study Period 2005-2007
# of Accidents - 36
I-95NB
1243 1-17-05 10:20P I/S Speed
1244 1-17-05 11:18A I/S Speed (B)
5840 2-21-05 12:59P I/S Speed
9436 3-14-05 10:00P I/S Inattention
25 1-1-07 7:00A I/SL Speed
28720 11-3-07 6:40P W/R Speed
33330 12-17-07 11:35A I/C Speed
24962 10-12-07 8:30A W/R Speed
1097 1-15-07 10:45P I/S Speed
34635 12-17-07 3:20P I/C Speed
33469 12-30-06 2:50P I/S Speed
21964 9-9-06 12:42P D/C Speed
35308 12-9-05 11:47A S/S Speed
33471 12-30-06 2:40P I/S Speed
4138 2-13-06 6:25A I/C Speed
14760 5-25-05 12:05P W/R Follow too Close (B)
15914 6-29-06 10:50A D/CL Speed
21968 9-12-06 5:30P D/C Follow too Close (C)
22887 9-24-06 11:35A D/CL Speed (C)
24137 9-21-06 4:05P D/C Follow too Close
25669 9-21-06 3:45P D/C Speed
23429 9-9-07 11:30A D/C Follow too Close
25090 10-13-07 1:50P D/C Inattention
25092 10-14-07 1:00P D/CL Speed (B)
23329 9-7-06 4:25P D/C Follow too Close
22395 9-23-06 3:40P W/R Follow too Close (C)
35785 10-13-07 3:00P D/C Follow too Close
34633 12-17-07 3:20P I/C Speed
32961 12-12-07 11:15A W/CL Inattention
25203 10-12-07 6:50P W/CL Fail to Yield
5809 3-2-06 9:18A I/S Follow too Close
5810 3-2-06 9:15A I/S Inattention
27367 10-16-07 4:45P D/C Inattention (C)
4137 2-13-06 6:55A I/C Follow too Close
21133 8-28-06 8:40A W/R Follow too Close
14322 5-19-05 4:25P D/CL Speed (C)
* = Construction Area
Prepared by M&O Traffic Engineering

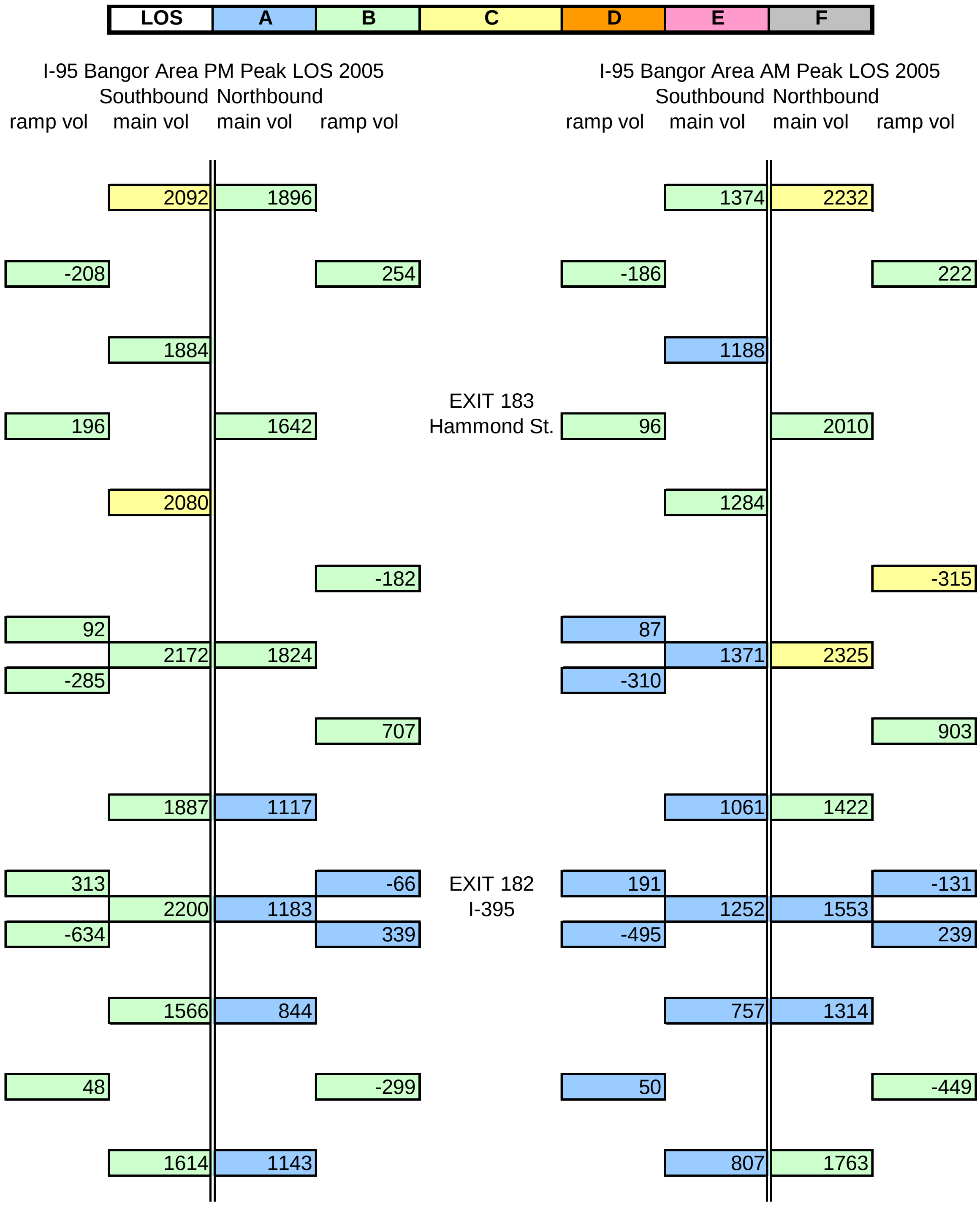

Sunset Lane
Union St Rt 222
Exit 47 S.B. Off Ramp to Union St
= Traffic Signal
Bangor
Node # 41293
Study period 2005-2007
# of Accidents-38
N
E
S
W


Hogan Rd
I-95 NB On Ramp
Bangor
41194
Study period 2005-2007
# of Accidents-39
Prepared by M&O Traffic Engineering
I-95 NB Off Ramp
= Traffic Signal
41194
Hogan Rd
N
E
S
W


Bangor
41287
Study period 2005-2007
# of Accidents-7
Prepared by M&O Traffic Engineering
guardrail
construction zone accidents
19171 1-7-05 12:50A D/C Inattention
I-95 South Bound
07417 2-10-05 2:00P I/S Speed #
04427 2-8-05 11:30A W/CL Fail to Yield #
Yield
guard-rail
03347 1-26-05 3:30P S/S Follow too Close
20547 1-17-05 5:50P D/C Inattention
30481 1-28-07 4:35P D/C Driver Inattention
23533 1-31-05 10:33A D/C Follow too Close
W.B. Ramp from I-395

LOS	A	B	C	D	E	F

I-95 Bangor Area PM Peak LOS 2005					I-95 Bangor Area AM Peak LOS 2005			
	Southbound	Northbound				Southbound	Northbound	
ramp vol	main vol	main vol	ramp vol		ramp vol	main vol	main vol	ramp vol
	1421	1501				1377	1212	
-429			489		-247			180
	992	1012		EXIT 187 Hogan Rd.		1130	1032	
1058			-650		316			-931
	2050					1446		
-175					-20			
	1875	1662		EXIT 186 Stillwater Ave.		1426	1963	
611			-492		133			-216
	2486	2154				1559	2179	
-509			420		-354			422
	1977	1734		EXIT 185 Broadway		1205	1757	
573			-540		459			-697
	2550	2274				1664	2454	
-691			520		-508			529
	1859	1754		EXIT 184 Union St. Ohio St.		1156	1925	
233			-142		218			-307


LOS
A
B
C
D
E
F
I-95 Bangor Area PM Peak LOS 2005
Southbound Northbound
ramp vol main vol main vol ramp vol
2092 1896
-208 254
1884
196 1642
2080
-182
92
2172 1824
-285
707
1887 1117
313 -66
2200 1183
-634 339
1566 844
48 -299
1614 1143
EXIT 183
Hammond St.
EXIT 182
I-395
I-95 Bangor Area AM Peak LOS 2005
Southbound Northbound
ramp vol main vol main vol ramp vol
1374 2232
-186 222
1188
96 2010
1284
-315
87
1371 2325
-310
903
1061 1422
191 -131
1252 1553
-495 239
757 1314
50 -449
807 1763

LOS	A	B	C	D	E	F

I-95 Bangor Area PM Peak LOS 2030

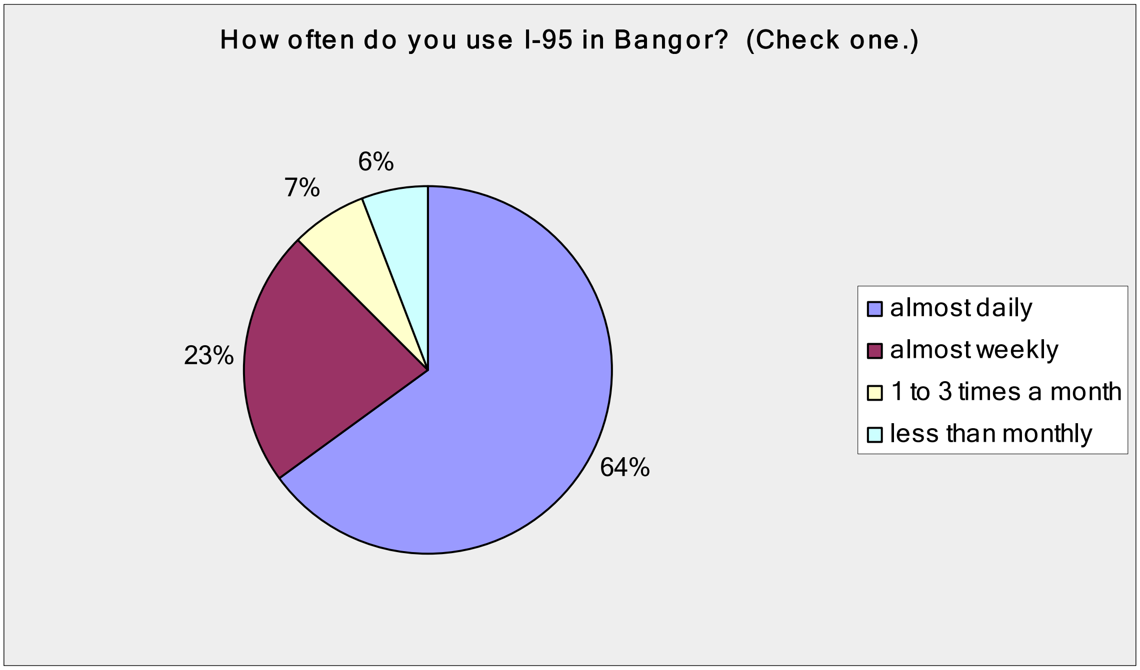
Southbound ramp vol	Southbound main vol	Northbound main vol	Northbound ramp vol	Exit
	1911	2019		
-577			658	
	1334	1361		EXIT 187 Hogan Rd.
1423			-874	
	2757			
-239				
	2522	2235		EXIT 186 Stillwater Ave
822			-662	
	3344	2897		
-685			565	
	2659	2332		EXIT 185 Broadway
771			-726	
	3430	3059		
-930			699	
	2500	2359		EXIT 184 Union St. Ohio St.
313			-191	

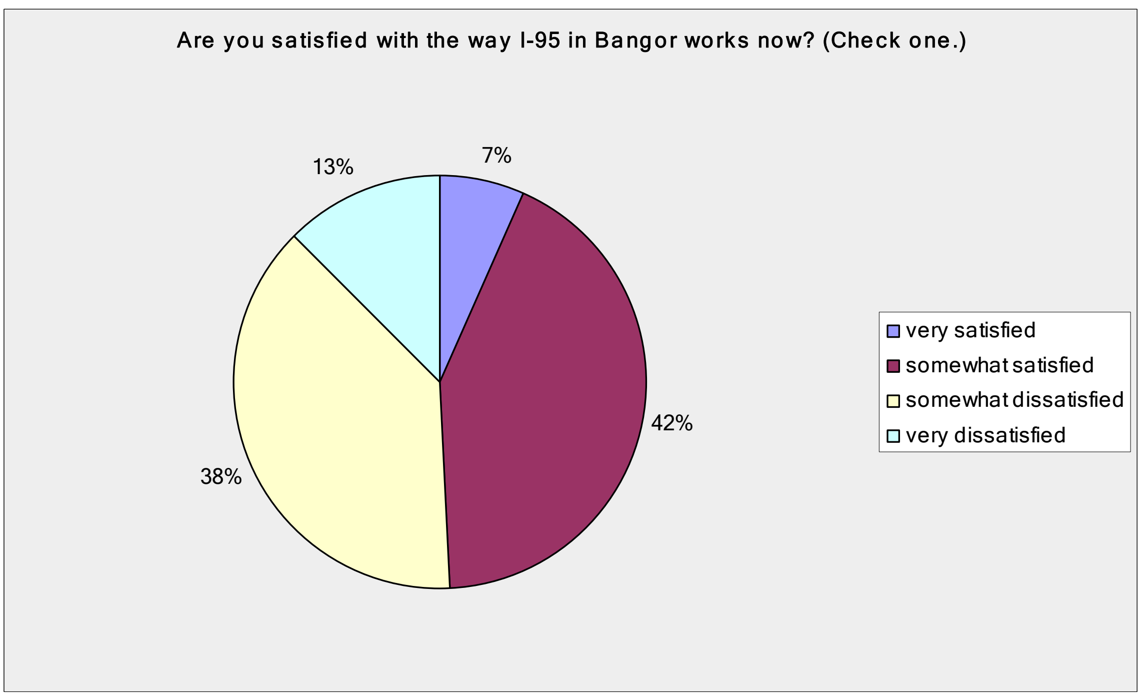
I-95 Bangor Area AM Peak LOS 2030

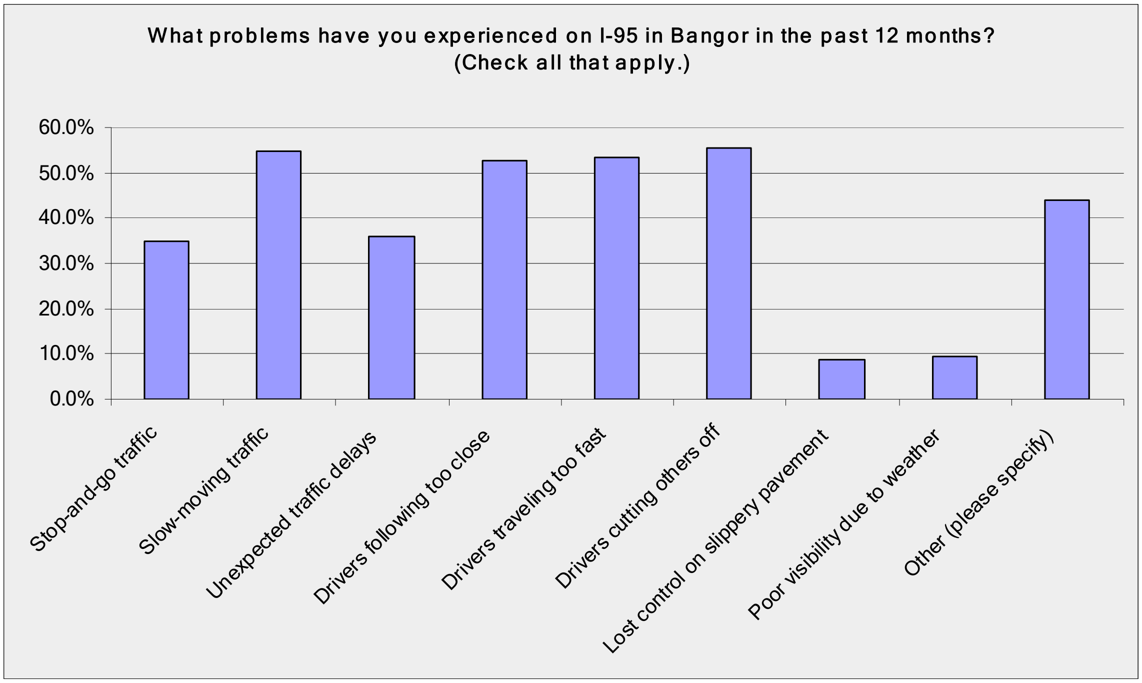
Southbound ramp vol	Southbound main vol	Northbound main vol	Northbound ramp vol	Exit
	1852	1630		
-332			242	
	1520	1388		EXIT 187 Hogan Rd.
425			-1252	
	1945			
-27				
	1918	2640		EXIT 186 Stillwater Ave
179			-291	
	2097	2931		
-476			568	
	1621	2363		EXIT 185 Broadway
617			-937	
	2238	3301		
-683			712	
	1555	2589		EXIT 184 Union St. Ohio St.
293			-413	

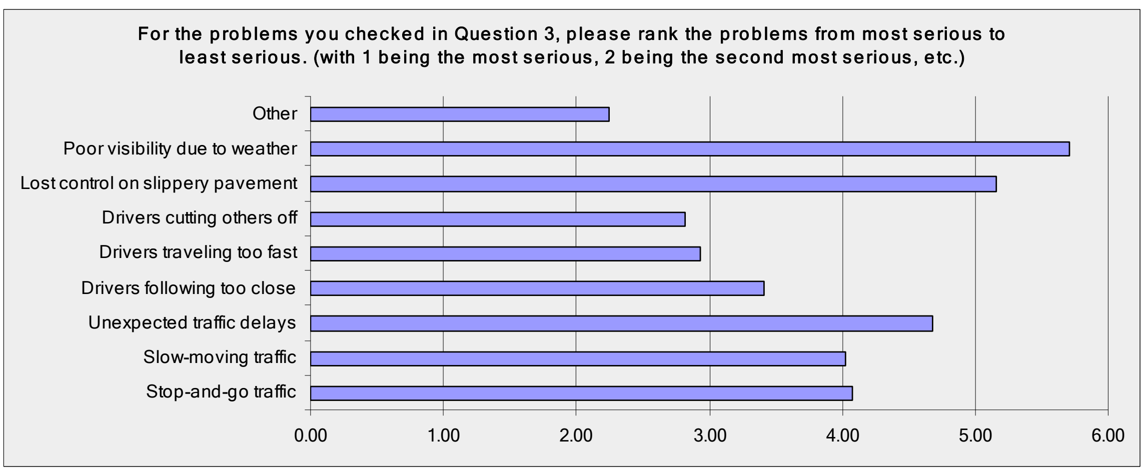
LOS	A	B	C	D	E	F

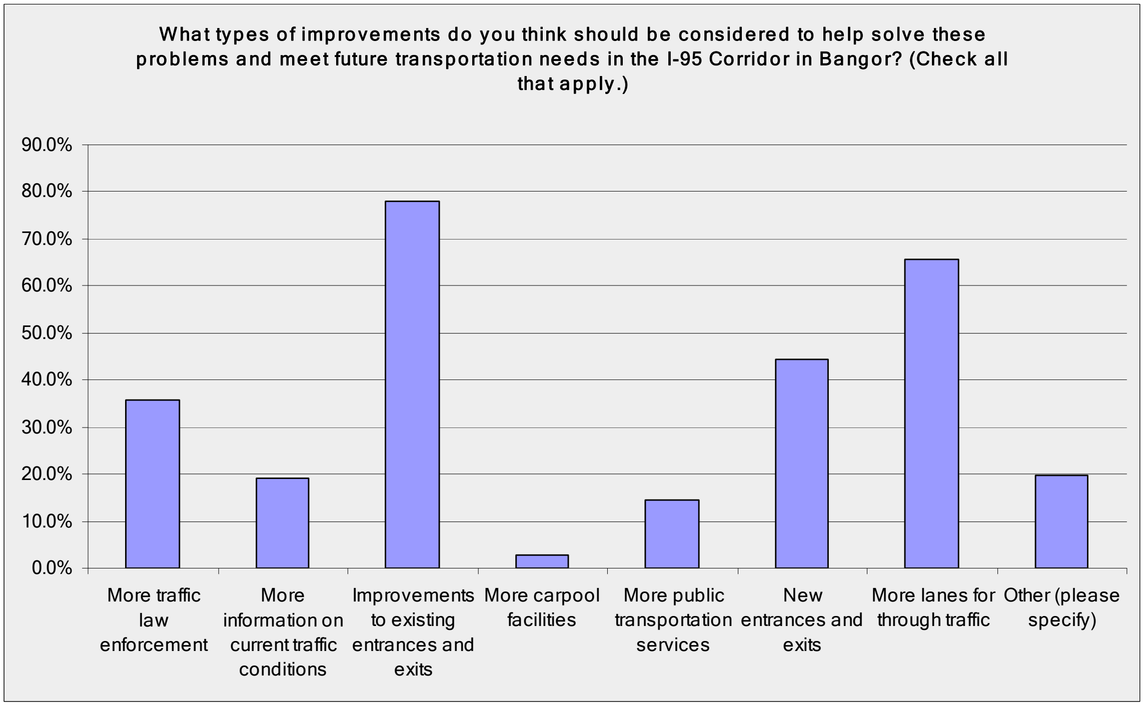
I-95 Bangor Area PM Peak LOS 2030					I-95 Bangor Area AM Peak LOS 2030			
	Southbound	Northbound				Southbound	Northbound	
ramp vol	main vol	main vol	ramp vol		ramp vol	main vol	main vol	ramp vol
	2814	2550				1848	3002	
-280			342		-250			299
	2534			EXIT 183 Hammond St.		1598		
264		2208			129		2703	
	2798					1727		
124			-245		117			-424
	2921	2453				1844	3127	
-383			951		-417			1215
	2538	1502				1427	1913	
421			-89	EXIT 182	257			-176
	2959	1591		I-395		1684	2089	
-853			456		-666			321
	2106	1135				1018	1767	
65			-402		67			-604
	2171	1537				1085	2371	


How often do you use I-95 in Bangor? (Check one.)
6%
7%
23%
64%
almost daily
almost weekly
1 to 3 times a month
less than monthly


Are you satisfied with the way I-95 in Bangor works now? (Check one.)
13%
7%
42%
38%
very satisfied
somewhat satisfied
somewhat dissatisfied
very dissatisfied


What problems have you experienced on I-95 in Bangor in the past 12 months?
(Check all that apply.)
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
Stop-and-go traffic
Slow-moving traffic
Unexpected traffic delays
Drivers following too close
Drivers traveling too fast
Drivers cutting others off
Lost control on slippery pavement
Poor visibility due to weather
Other (please specify)


For the problems you checked in Question 3, please rank the problems from most serious to least serious. (with 1 being the most serious, 2 being the second most serious, etc.)
Other
Poor visibility due to weather
Lost control on slippery pavement
Drivers cutting others off
Drivers traveling too fast
Drivers following too close
Unexpected traffic delays
Slow-moving traffic
Stop-and-go traffic
0.00
1.00
2.00
3.00
4.00
5.00
6.00


What types of improvements do you think should be considered to help solve these problems and meet future transportation needs in the I-95 Corridor in Bangor? (Check all that apply.)
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
More traffic law enforcement
More information on current traffic conditions
Improvements to existing entrances and exits
More carpool facilities
More public transportation services
New entrances and exits
More lanes for through traffic
Other (please specify)

BANGOR INTERSTATE 95 BRIDGES

9/27/2010

BRIDGE #	CITY	BRIDGE NAME	FEATURE ON STRUCTURE	FEATURE UNDER STRUCTURE	SUB-STRUCTURE CONDITION	SUPER-STRUCTURE CONDITION	DECK CONDITION	PROGRAM YEAR	SCOPE DESCRIPTION
1429	Bangor	I95SB / PERRY RD & MCRR	I-95 SOUTHBOUND	MCRR-PERRY RD	5	7	7		
1428	Bangor	I95 SB / INDUSTRIAL SPUR	I-95 SOUTHBOUND	INDUSTRIAL SPUR (I-395)	8	7	9		
1427	Bangor	I95 SB / STILLWATER AVE	I-95 SOUTHBOUND	STILLWATER AVENUE	6	8	6		
1426	Bangor	I95 SB / PENJAJAWOC STR	I-95 SOUTHBOUND	PENJAJAWOCK BROOK	N	N	N		
5789	Bangor	I-95/BROADWAY	I-95	ROUTE 15	5	7	6		
5800	Bangor	I-95 NB / STILLWATER AVE	I95 NORTHBOUND	STILLWATER AVENUE	6	8	6		
5798	Bangor	KENDUSKEAG AVENUE / I95	KENDUSKEAG AVENUE	INTERSTATE 95	6	7	5		
5797	Bangor	UNION STREET / I95	ROUTE 222	INTERSTATE 95	5	6	4	12/13	BRIDGE REPLACEMENT
5795	Bangor	I95 NB / INDUSTRIAL SPUR	I-95 NORTHBOUND	INDSTRIAL SPUR (I-395)	8	7	9		
5794	Bangor	HAMMOND STREET / I95	ROUTES US2 & 100	INTERSTATE 95	4	6	5	08/09	BRIDGE REPLACEMENT
5790	Bangor	OHIO ST./I-95	SA 6	I-95 NB & SB	5	7	4	12/13	BRIDGE REPLACEMENT
5823	Bangor	HOGAN ROAD / I95	HOGAN ROAD	INTERSTATE 95	6	6	6		
5850	Bangor	PENJAJAWOC STREAM NB	I-95	PENJAJAWOCK BROOK	N	N	N		
5972	Bangor	I95 NB/PERRY RD & MCRR	I-95 NB	MCRR-PERRY RD	5	7	7		
5822	Bangor	ESSEX STREET / I95	ESSEX STREET	INTERSTATE 95	8	9	8	08/09	BRIDGE REPLACEMENT
5971	Bangor	ACCESS ROAD/I-95	ACCESS RD - SA	INTERSTATE 95	6	7	6		
5791	Bangor	I95 / KENDUSKEAG STREAM	INTERSTATE 95	KENDUSKEAG STREAM & VALLEY AVENUE	7	3	6	02/03	BRIDGE DECK REHABILITATION
6411	Bangor	STILLWATER INTERCHANGE	STILLWATER INTERCHANGE	I -95 NB	8	8	8		
6412	Bangor	STILLWATER INTERCHANGE	STILLWATER INTERCHANGE	I-95 SB	8	8	8		

Condition Ratings range from 0 to 9, with 0 to 4 being "poor", 5 to 6 being "fair", and 7 to 9 being "good".

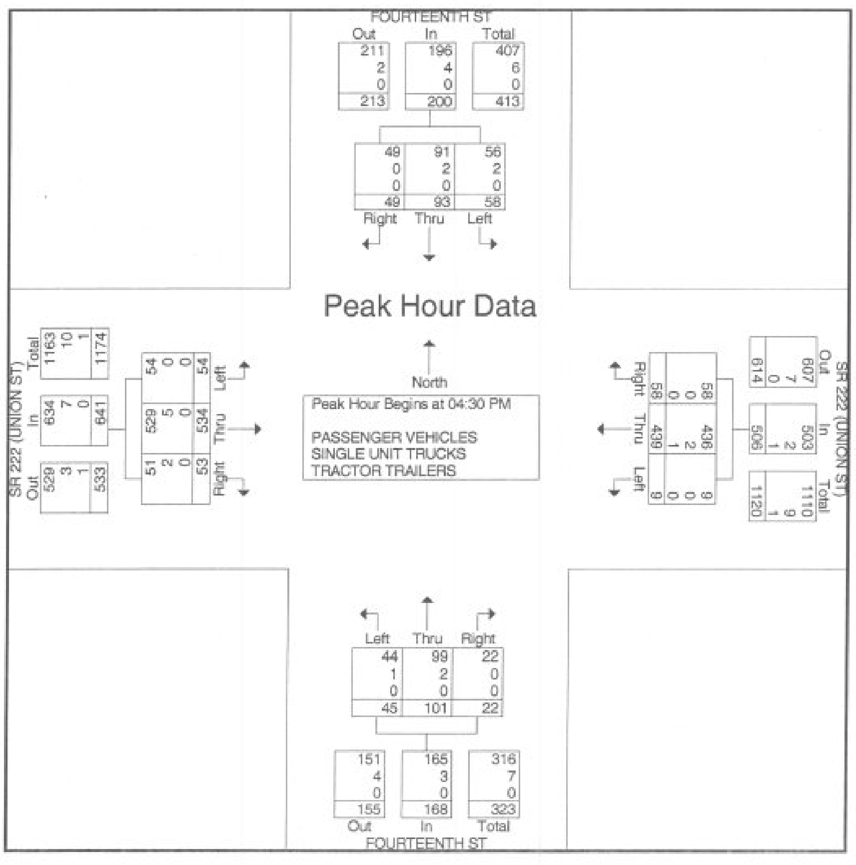
N means "not applicable" (culvert structure).

MAINE DEPARTMENT OF TRANSPORTATION
TRAFFIC ENGINEERING DIVISION
TRAFFIC MONITORING SECTION

BANGOR SUNNY / SUNNY
FOURTEENTH ST, SR 222 (UNION ST)
BOB KNOX / AL WEISBACKER
2387 / 2195

File Name : BANGOR-065-TM
Site Code : 19020065
Start Date : 8/22/2008
Page No : 4

	FOURTEENTH ST From North				SR 222 (UNION ST) From East				FOURTEENTH ST From South				SR 222 (UNION ST) From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:30 PM																	
04:30 PM	**18**	23	10	51	**3**	112	12	127	13	19	5	37	14	122	**15**	151	366
04:45 PM	16	**28**	13	**57**	3	101	15	119	8	18	**7**	33	9	120	11	140	349
05:00 PM	10	22	10	42	1	111	14	126	**14**	**35**	3	**52**	14	139	13	166	386
05:15 PM	14	20	**16**	50	2	**115**	**17**	**134**	10	29	7	46	**17**	**153**	14	**184**	**414**
Total Volume	58	93	49	200	9	439	58	506	45	101	22	168	54	534	53	641	1515
% App. Total	29	46.5	24.5		1.8	86.8	11.5		26.8	60.1	13.1		8.4	83.3	8.3		
PHF	.806	.830	.766	.877	.750	.954	.853	.944	.804	.721	.786	.808	.794	.873	.883	.871	.915
PASSENGER VEHICLES	56	91	49	196	9	436	58	503	44	99	22	165	54	529	51	634	1498
% PASSENGER VEHICLES	96.6	97.8	100	98.0	100	99.3	100	99.4	97.8	98.0	100	98.2	100	99.1	96.2	98.9	98.9
SINGLE UNIT TRUCKS	2	2	0	4	0	2	0	2	1	2	0	3	0	5	2	7	16
% SINGLE UNIT TRUCKS	3.4	2.2	0	2.0	0	0.5	0	0.4	2.2	2.0	0	1.8	0	0.9	3.8	1.1	1.1
TRACTOR TRAILERS	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1
% TRACTOR TRAILERS	0	0	0	0	0	0.2	0	0.2	0	0	0	0	0	0	0	0	0.1

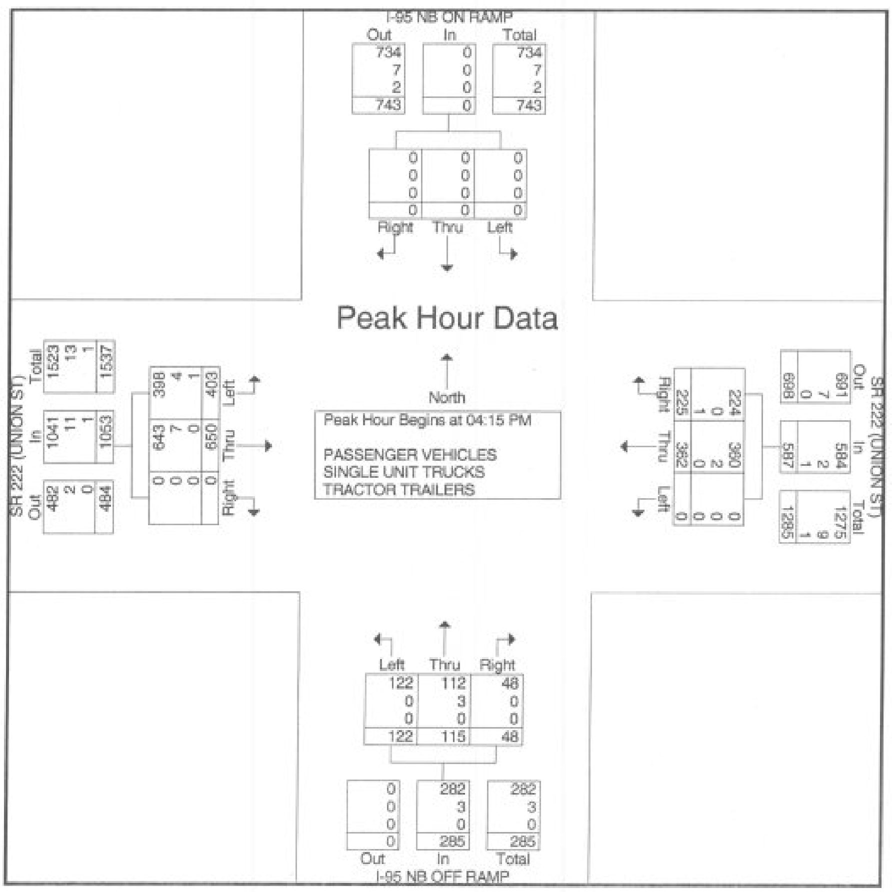


MAINE DEPARTMENT OF TRANSPORTATION
TRAFFIC ENGINEERING DIVISION
TRAFFIC MONITORING SECTION

BANGOR SUNNY / SUNNY
I-95 NB ON RAMP,SR 222 UNION,I-95 NB OFF
LUKE CHAMBERLAIN / JOHN GORDON
1983 / 2198

File Name : BANGOR-183-TM
Site Code : 19020183
Start Date : 8/22/2008
Page No : 4

	I-95 NB ON RAMP From North				SR 222 (UNION ST) From East				I-95 NB OFF RAMP From South				SR 222 (UNION ST) From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:15 PM																	
04:15 PM	0	0	0	0	0	95	52	147	31	23	**15**	69	100	164	0	264	480
04:30 PM	0	0	0	0	0	91	**63**	**154**	29	20	10	59	**119**	150	0	269	482
04:45 PM	0	0	0	0	0	80	57	137	**35**	30	11	76	79	152	0	231	444
05:00 PM	0	0	0	0	0	**96**	53	149	27	**42**	12	**81**	105	**184**	0	**289**	**519**
Total Volume	0	0	0	0	0	362	225	587	122	115	48	285	403	650	0	1053	1925
% App. Total	0	0	0		0	61.7	38.3		42.8	40.4	16.8		38.3	61.7	0		
PHF	.000	.000	.000	.000	.000	.943	.893	.953	.871	.685	.800	.880	.847	.883	.000	.911	.927
PASSENGER VEHICLES	0	0	0	0	0	360	224	584	122	112	48	282	398	643	0	1041	1907
% PASSENGER VEHICLES	0	0	0	0	0	99.4	99.6	99.5	100	97.4	100	98.9	98.8	98.9	0	98.9	99.1
SINGLE UNIT TRUCKS	0	0	0	0	0	2	0	2	0	3	0	3	4	7	0	11	16
% SINGLE UNIT TRUCKS	0	0	0	0	0	0.6	0	0.3	0	2.6	0	1.1	1.0	1.1	0	1.0	0.8
TRACTOR TRAILERS	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	1	2
% TRACTOR TRAILERS	0	0	0	0	0	0	0.4	0.2	0	0	0	0	0.2	0	0	0.1	0.1

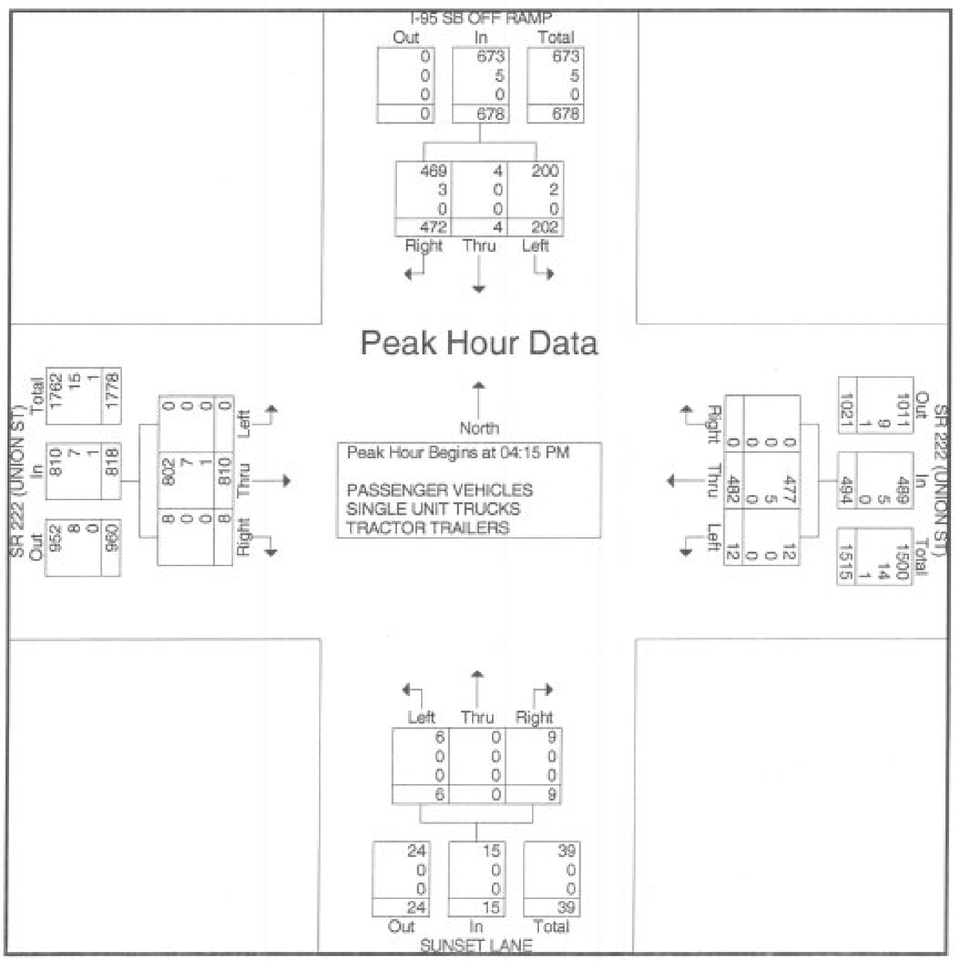


MAINE DEPARTMENT OF TRANSPORTATION
TRAFFIC ENGINEERING DIVISION
TRAFFIC MONITORING SECTION

BANGOR SUNNY / SUNNY
I-95 SB OFF RAMP,SR 222(UNION ST),SUNSET
IVY DONNELL / LARRY RONCO
2194 / 2382

File Name : BANGOR-182-TM
Site Code : 19020182
Start Date : 8/22/2008
Page No : 4

	I-95 SB OFF RAMP From North				SR 222 (UNION ST) From East				SUNSET LANE From South				SR 222 (UNION ST) From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:15 PM																	
04:15 PM	45	0	122	167	**4**	124	0	128	1	0	3	4	0	210	2	212	511
04:30 PM	45	**2**	**130**	**177**	2	120	0	122	**2**	0	0	2	0	208	**3**	211	512
04:45 PM	55	2	108	165	2	111	0	113	1	0	**4**	**5**	0	167	1	168	451
05:00 PM	**57**	0	112	169	4	**127**	0	**131**	2	0	2	4	0	**225**	2	**227**	**531**
Total Volume	202	4	472	678	12	482	0	494	6	0	9	15	0	810	8	818	2005
% App. Total	29.8	0.6	69.6		2.4	97.6	0		40	0	60		0	99	1		
PHF	.886	.500	.908	.958	.750	.949	.000	.943	.750	.000	.563	.750	.000	.900	.667	.901	.944
PASSENGER VEHICLES	200	4	469	673	12	477	0	489	6	0	9	15	0	802	8	810	1987
% PASSENGER VEHICLES	99.0	100	99.4	99.3	100	99.0	0	99.0	100	0	100	100	0	99.0	100	99.0	99.1
SINGLE UNIT TRUCKS	2	0	3	5	0	5	0	5	0	0	0	0	0	7	0	7	17
% SINGLE UNIT TRUCKS	1.0	0	0.6	0.7	0	1.0	0	1.0	0	0	0	0	0	0.9	0	0.9	0.8
TRACTOR TRAILERS	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
% TRACTOR TRAILERS	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0.1	0.0

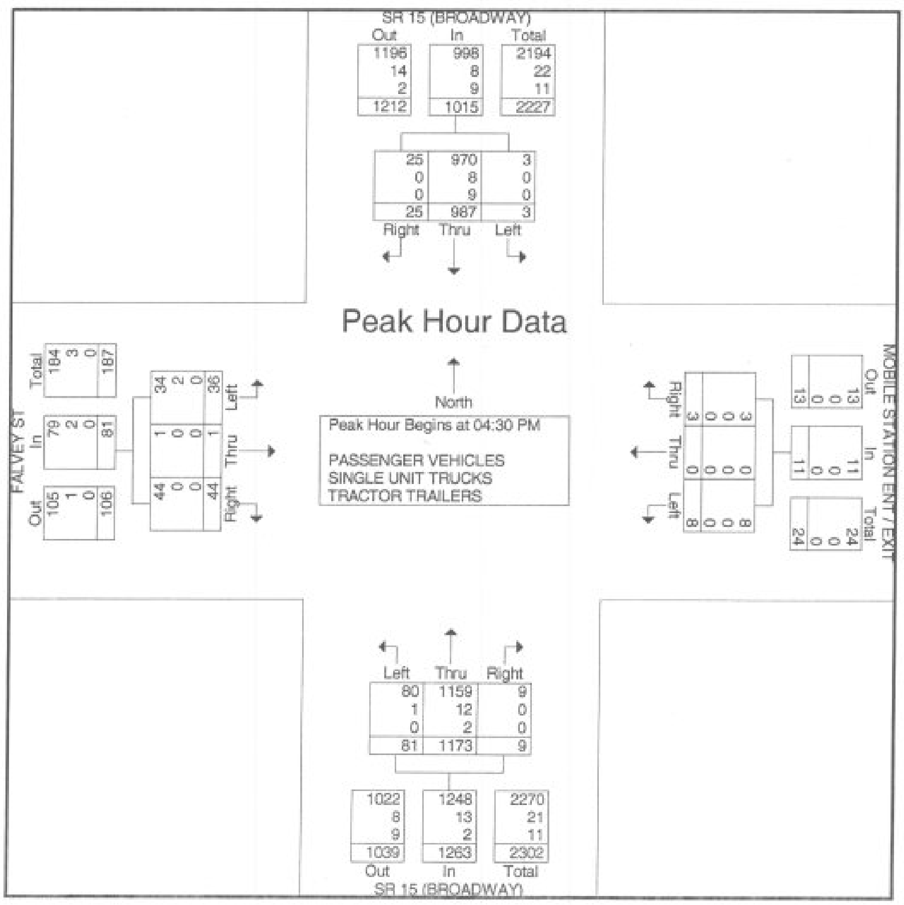


MAINE DEPARTMENT OF TRANSPORTATION
TRAFFIC ENGINEERING DIVISION
TRAFFIC MONITORING SECTION

BANGOR RAIN / SUNNY
SR 15(BROADWAY), MOBILE STA ENT/,FALVEY
LUKE CHAMBERLAIN / BOB KNOX
1918 /2911

File Name : BANGOR-088-TM
Site Code : 19020088
Start Date : 8/20/2008
Page No : 4

	SR 15 (BROADWAY) From North				MOBILE STATION ENT / EXIT From East				SR 15 (BROADWAY) From South				FALVEY ST From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:30 PM																	
04:30 PM	**1**	247	3	251	1	0	1	2	**25**	270	1	296	7	0	11	18	567
04:45 PM	0	236	6	242	2	0	1	3	24	274	**3**	301	11	0	12	23	569
05:00 PM	1	**295**	7	**303**	**4**	0	0	**4**	17	276	2	295	6	0	8	14	616
05:15 PM	1	209	**9**	219	1	0	1	2	15	**353**	3	**371**	**12**	**1**	**13**	**26**	**618**
Total Volume	3	987	25	1015	8	0	3	11	81	1173	9	1263	36	1	44	81	2370
% App. Total	0.3	97.2	2.5		72.7	0	27.3		6.4	92.9	0.7		44.4	1.2	54.3		
PHF	.750	.836	.694	.837	.500	.000	.750	.688	.810	.831	.750	.851	.750	.250	.846	.779	.959
PASSENGER VEHICLES	3	970	25	998	8	0	3	11	80	1159	9	1248	34	1	44	79	2336
% PASSENGER VEHICLES	100	98.3	100	98.3	100	0	100	100	98.8	98.8	100	98.8	94.4	100	100	97.5	98.6
SINGLE UNIT TRUCKS	0	8	0	8	0	0	0	0	1	12	0	13	2	0	0	2	23
% SINGLE UNIT TRUCKS	0	0.8	0	0.8	0	0	0	0	1.2	1.0	0	1.0	5.6	0	0	2.5	1.0
TRACTOR TRAILERS	0	9	0	9	0	0	0	0	0	2	0	2	0	0	0	0	11
% TRACTOR TRAILERS	0	0.9	0	0.9	0	0	0	0	0	0.2	0	0.2	0	0	0	0	0.5

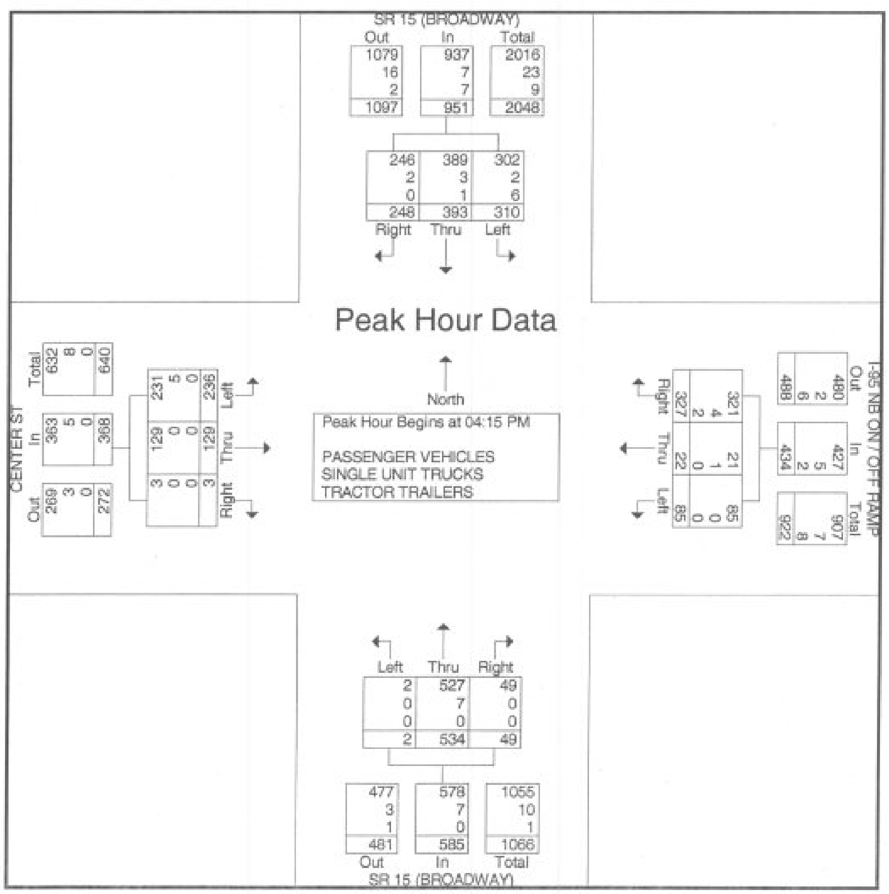


MAINE DEPARTMENT OF TRANSPORTATION
TRAFFIC ENGINEERING DIVISION
TRAFFIC MONITORING SECTION

BANGOR RAIN / SUNNY
SR 15(BROADWAY,I-95 NB ON/OFF RMP,CENTE
IVY DONNELL / LARRY RONCO
2192 / 2384

File Name : BANGOR-173-TM
Site Code : 19020173
Start Date : 8/20/2008
Page No : 4

	SR 15 (BROADWAY) From North				I-95 NB ON / OFF RAMP From East				SR 15 (BROADWAY) From South				CENTER ST From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:15 PM																	
04:15 PM	73	101	**69**	243	19	4	59	82	0	134	11	145	58	21	**2**	81	551
04:30 PM	**81**	88	51	220	16	**7**	86	109	0	125	13	138	54	**38**	0	92	559
04:45 PM	76	91	67	234	23	6	82	111	**2**	131	11	144	50	37	0	87	576
05:00 PM	80	**113**	61	**254**	**27**	5	**100**	**132**	0	**144**	**14**	**158**	**74**	33	1	**108**	**652**
Total Volume	310	393	248	951	85	22	327	434	2	534	49	585	236	129	3	368	2338
% App. Total	32.6	41.3	26.1		19.6	5.1	75.3		0.3	91.3	8.4		64.1	35.1	0.8		
PHF	.957	.869	.899	.936	.787	.786	.818	.822	.250	.927	.875	.926	.797	.849	.375	.852	.896
PASSENGER VEHICLES	302	389	246	937	85	21	321	427	2	527	49	578	231	129	3	363	2305
% PASSENGER VEHICLES	97.4	99.0	99.2	98.5	100	95.5	98.2	98.4	100	98.7	100	98.8	97.9	100	100	98.6	98.6
SINGLE UNIT TRUCKS	2	3	2	7	0	1	4	5	0	7	0	7	5	0	0	5	24
% SINGLE UNIT TRUCKS	0.6	0.8	0.8	0.7	0	4.5	1.2	1.2	0	1.3	0	1.2	2.1	0	0	1.4	1.0
TRACTOR TRAILERS	6	1	0	7	0	0	2	2	0	0	0	0	0	0	0	0	9
% TRACTOR TRAILERS	1.9	0.3	0	0.7	0	0	0.6	0.5	0	0	0	0	0	0	0	0	0.4

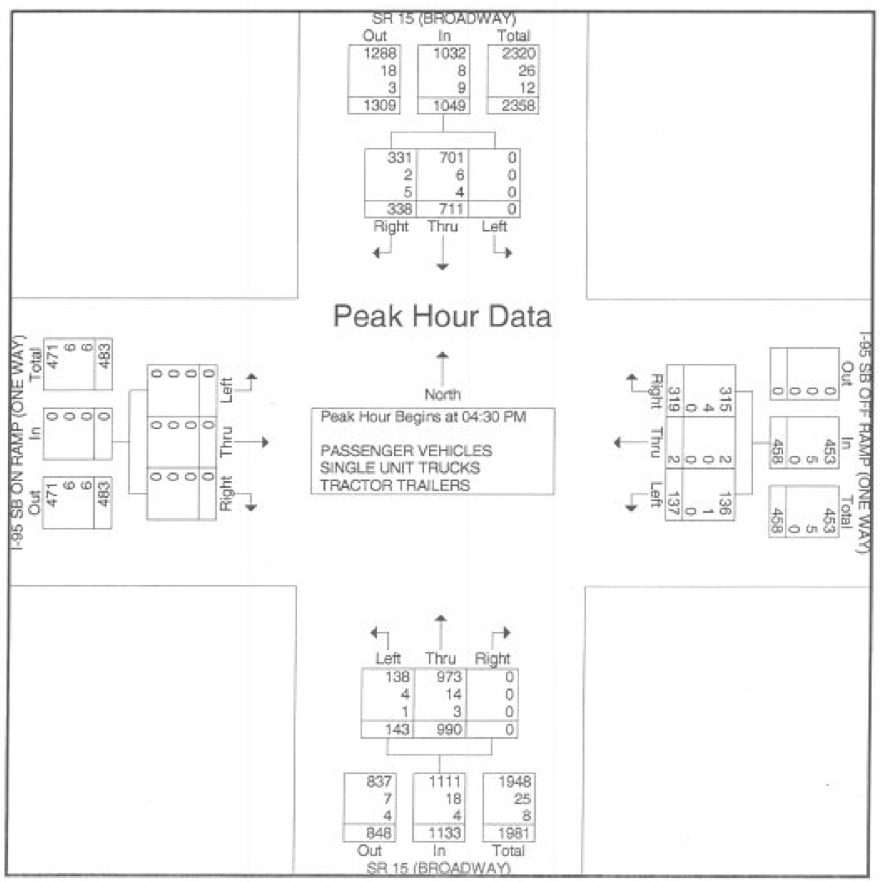


MAINE DEPARTMENT OF TRANSPORTATION
TRAFFIC ENGINEERING DIVISION
TRAFFIC MONITORING SECTION

BANGOR RAIN / SUNNY
SR 15 (BROADWAY), I-95 SB OFF/ ON RMP
SHERIDAN BAILEY /AL WEISBACKER
2906 / 2907

File Name : BANGOR-177-TM
Site Code : 19020177
Start Date : 8/20/2008
Page No : 4

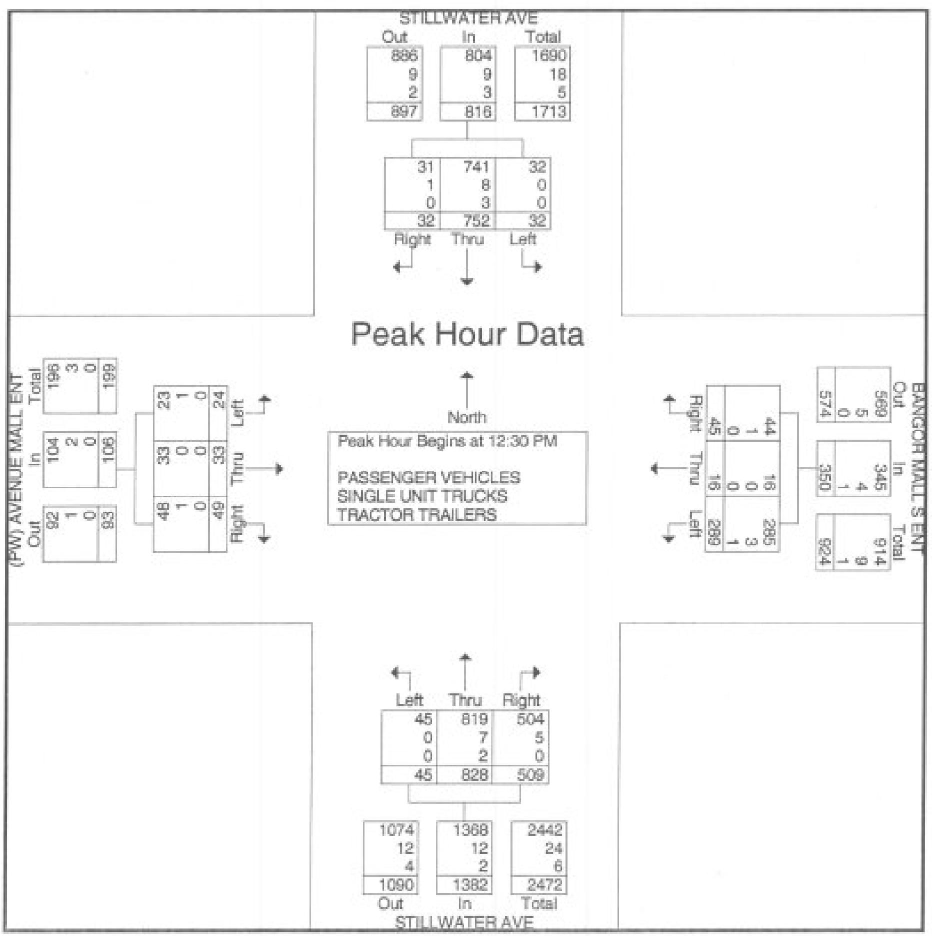
	SR 15 (BROADWAY) From North				I-95 SB OFF RAMP (ONE WAY) From East				SR 15 (BROADWAY) From South				I-95 SB ON RAMP (ONE WAY) From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:30 PM																	
04:30 PM	0	180	88	268	34	**1**	**87**	122	**48**	218	0	266	0	0	0	0	656
04:45 PM	0	188	76	264	27	1	78	106	33	237	0	270	0	0	0	0	640
05:00 PM	0	**191**	**89**	**280**	**49**	0	75	**124**	35	229	0	264	0	0	0	0	668
05:15 PM	0	152	85	237	27	0	79	106	27	**306**	0	**333**	0	0	0	0	**676**
Total Volume	0	711	338	1049	137	2	319	458	143	990	0	1133	0	0	0	0	2640
% App. Total	0	67.8	32.2		29.9	0.4	69.7		12.6	87.4	0		0	0	0		
PHF	.000	.931	.949	.937	.699	.500	.917	.923	.745	.809	.000	.851	.000	.000	.000	.000	.976
PASSENGER VEHICLES	0	701	331	1032	136	2	315	453	138	973	0	1111	0	0	0	0	2596
% PASSENGER VEHICLES	0	98.6	97.9	98.4	99.3	100	98.7	98.9	96.5	98.3	0	98.1	0	0	0	0	98.3
SINGLE UNIT TRUCKS	0	6	2	8	1	0	4	5	4	14	0	18	0	0	0	0	31
% SINGLE UNIT TRUCKS	0	0.8	0.6	0.8	0.7	0	1.3	1.1	2.8	1.4	0	1.6	0	0	0	0	1.2
TRACTOR TRAILERS	0	4	5	9	0	0	0	0	1	3	0	4	0	0	0	0	13
% TRACTOR TRAILERS	0	0.6	1.5	0.9	0	0	0	0	0.7	0.3	0	0.4	0	0	0	0	0.5



BANGOR SUNNY / MOSTLY CLOUDY
STILLWATER AVE, BANGOR MALL S ENT, AVENU
SHERIDAN BAILEY / LUKE CHAMBERLAIN
2380 / 2381

File Name : BANGOR-111-TM
Site Code : 19020111
Start Date : 8/26/2008
Page No : 4

	STILLWATER AVE From North				BANGOR MALL S ENT From East				STILLWATER AVE From South				(PW) AVENUE MALL ENT From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 12:30 PM																	
12:30 PM	**10**	201	8	219	60	2	11	73	**20**	205	126	351	**12**	5	**13**	30	**673**
12:45 PM	10	150	7	167	**77**	**5**	11	93	14	**225**	**134**	**373**	6	**13**	13	**32**	665
01:00 PM	4	196	**9**	209	75	5	**17**	**97**	5	199	127	331	4	13	12	29	666
01:15 PM	8	**205**	8	**221**	77	4	6	87	6	199	122	327	2	2	11	15	650
Total Volume	32	752	32	816	289	16	45	350	45	828	509	1382	24	33	49	106	2654
% App. Total	3.9	92.2	3.9		82.6	4.6	12.9		3.3	59.9	36.8		22.6	31.1	46.2		
PHF	.800	.917	.889	.923	.938	.800	.662	.902	.563	.920	.950	.926	.500	.635	.942	.828	.986
PASSENGER VEHICLES	32	741	31	804	285	16	44	345	45	819	504	1368	23	33	48	104	2621
% PASSENGER VEHICLES	100	98.5	96.9	98.5	98.6	100	97.8	98.6	100	98.9	99.0	99.0	95.8	100	98.0	98.1	98.8
SINGLE UNIT TRUCKS	0	8	1	9	3	0	1	4	0	7	5	12	1	0	1	2	27
% SINGLE UNIT TRUCKS	0	1.1	3.1	1.1	1.0	0	2.2	1.1	0	0.8	1.0	0.9	4.2	0	2.0	1.9	1.0
TRACTOR TRAILERS	0	3	0	3	1	0	0	1	0	2	0	2	0	0	0	0	6
% TRACTOR TRAILERS	0	0.4	0	0.4	0.3	0	0	0.3	0	0.2	0	0.1	0	0	0	0	0.2

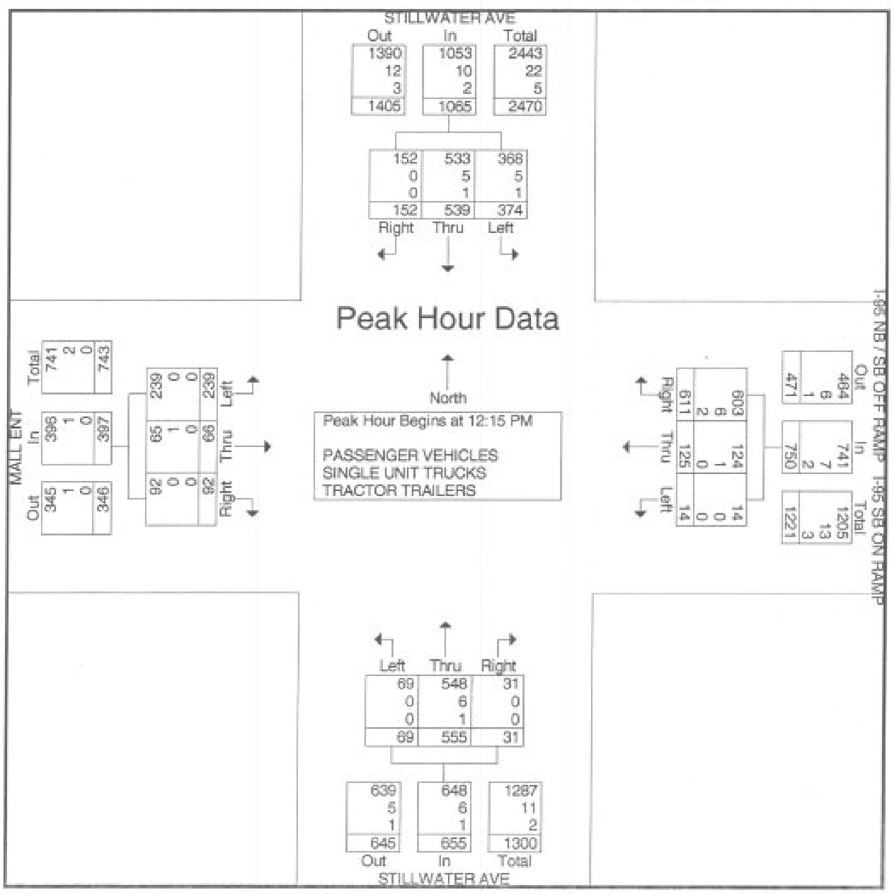


MAINE DEPARTMENT OF TRANSPORTATION
TRAFFIC ENGINEERING DIVISION
TRAFFIC MONITORING SECTION

BANGOR SUNNY / MOSTLY CLOUDY
STILLWATER AVE,I-95 NB/SB OFF RAMP,MALL
IVY DONNELL / AL WEISBACKER
2196 / 2197

File Name : BANGOR-200-TM
Site Code : 19020200
Start Date : 8/26/2008
Page No : 4

	STILLWATER AVE From North				I-95 NB / SB OFF RAMP I-95 SB ON RAMP From East				STILLWATER AVE From South				MALL ENT From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 12:15 PM																	
12:15 PM	91	104	23	218	5	**33**	**178**	**216**	**21**	147	7	175	51	11	21	83	692
12:30 PM	87	150	40	277	1	31	146	178	20	**153**	8	**181**	**79**	15	28	**122**	**758**
12:45 PM	90	128	**47**	265	**7**	33	168	208	17	142	7	166	57	13	13	83	722
01:00 PM	**106**	**157**	42	**305**	1	28	119	148	11	113	**9**	133	52	**27**	**30**	109	695
Total Volume	374	539	152	1065	14	125	611	750	69	555	31	655	239	66	92	397	2867
% App. Total	35.1	50.6	14.3		1.9	16.7	81.5		10.5	84.7	4.7		60.2	16.6	23.2		
PHF	.882	.858	.809	.873	.500	.947	.858	.868	.821	.907	.861	.905	.756	.611	.767	.814	.946
PASSENGER VEHICLES	368	533	152	1053	14	124	603	741	69	548	31	648	239	65	92	396	2838
% PASSENGER VEHICLES	98.4	98.9	100	98.9	100	99.2	98.7	98.8	100	98.7	100	98.9	100	98.5	100	99.7	99.0
SINGLE UNIT TRUCKS	5	5	0	10	0	1	6	7	0	6	0	6	0	1	0	1	24
% SINGLE UNIT TRUCKS	1.3	0.9	0	0.9	0	0.8	1.0	0.9	0	1.1	0	0.9	0	1.5	0	0.3	0.8
TRACTOR TRAILERS	1	1	0	2	0	0	2	2	0	1	0	1	0	0	0	0	5
% TRACTOR TRAILERS	0.3	0.2	0	0.2	0	0	0.3	0.3	0	0.2	0	0.2	0	0	0	0	0.2

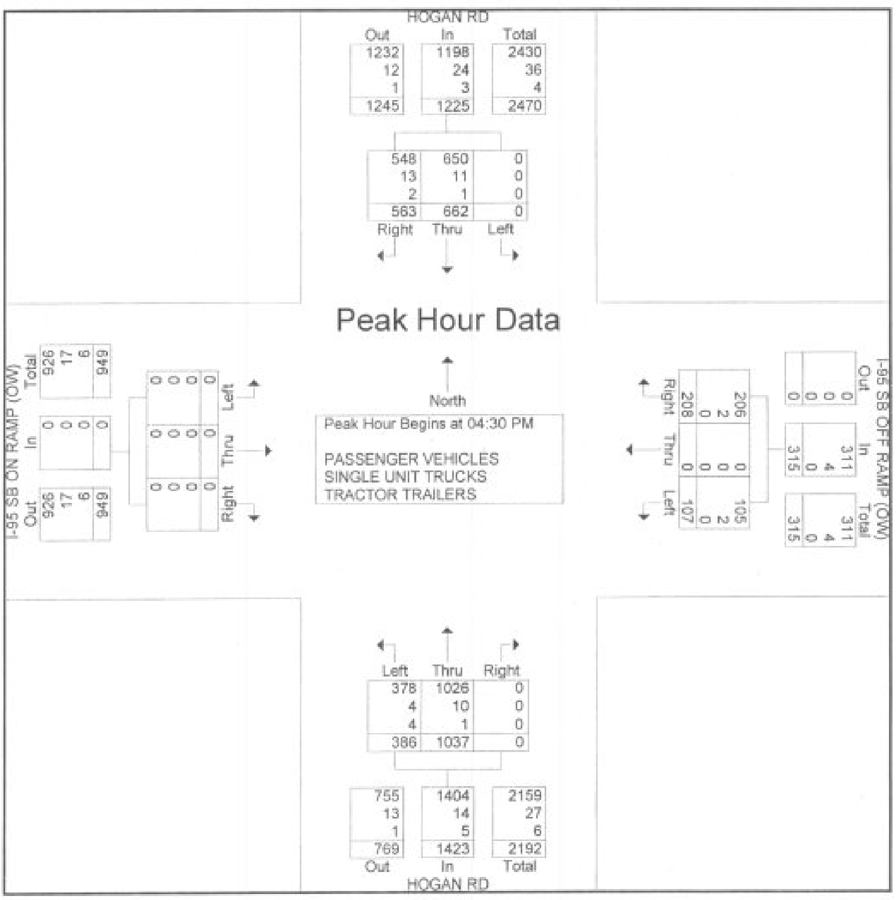


MAINE DEPARTMENT OF TRANSPORTATION
TRAFFIC ENGINEERING DIVISION
TRAFFIC MONITORING SECTION

BANGOR SUNNY
HOGAN RD,I-95 SB OFF RAMP,I-95 SB ON RMP
KNOX / RONCO / GORDON
2383 / 2385 / 2386

File Name : BANGOR-184-TM-S
Site Code : 19020184
Start Date : 8/28/2008
Page No : 4

	HOGAN RD From North				I-95 SB OFF RAMP (OW) From East				HOGAN RD From South				I-95 SB ON RAMP (OW) From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:30 PM																	
04:30 PM	0	155	141	296	22	0	**59**	81	100	224	0	324	0	0	0	0	701
04:45 PM	0	156	132	288	30	0	43	73	87	256	0	343	0	0	0	0	704
05:00 PM	0	**181**	137	318	**32**	0	56	**88**	94	253	0	347	0	0	0	0	753
05:15 PM	0	170	**153**	**323**	23	0	50	73	**105**	**304**	0	**409**	0	0	0	0	**805**
Total Volume	0	662	563	1225	107	0	208	315	386	1037	0	1423	0	0	0	0	2963
% App. Total	0	54	46		34	0	66		27.1	72.9	0		0	0	0		
PHF	.000	.914	.920	.948	.836	.000	.881	.895	.919	.853	.000	.870	.000	.000	.000	.000	.920
PASSENGER VEHICLES	0	650	548	1198	105	0	206	311	378	1026	0	1404	0	0	0	0	2913
% PASSENGER VEHICLES	0	98.2	97.3	97.8	98.1	0	99.0	98.7	97.9	98.9	0	98.7	0	0	0	0	98.3
SINGLE UNIT TRUCKS	0	11	13	24	2	0	2	4	4	10	0	14	0	0	0	0	42
% SINGLE UNIT TRUCKS	0	1.7	2.3	2.0	1.9	0	1.0	1.3	1.0	1.0	0	1.0	0	0	0	0	1.4
TRACTOR TRAILERS	0	1	2	3	0	0	0	0	4	1	0	5	0	0	0	0	8
% TRACTOR TRAILERS	0	0.2	0.4	0.2	0	0	0	0	1.0	0.1	0	0.4	0	0	0	0	0.3

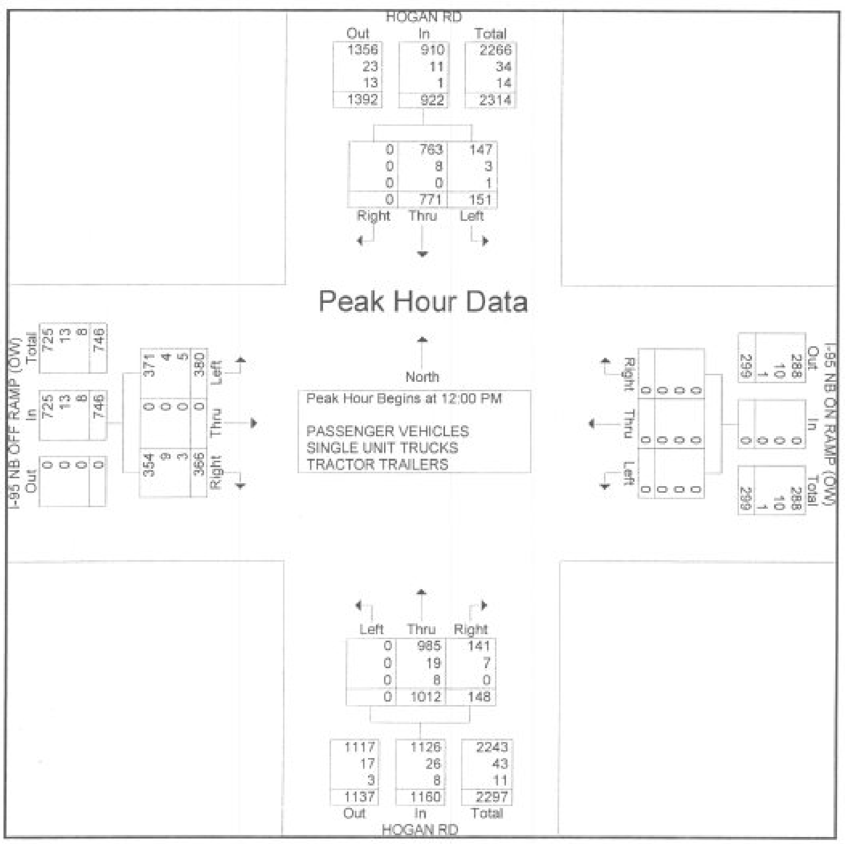


MAINE DEPARTMENT OF TRANSPORTATION
TRAFFIC ENGINEERING DIVISION
TRAFFIC MONITORING SECTION

BANGOR SUNNY
HOGAN RD,I-95 NB ON RAMP,I-95 NB OFF RM
WEISBACKER / DONNELL / BAILEY
1915 / 1917 / 2200

File Name : BANGOR-184-TM-N
Site Code : 19020184
Start Date : 8/28/2008
Page No : 4

	HOGAN RD From North				I-95 NB ON RAMP (OW) From East				HOGAN RD From South				I-95 NB OFF RAMP (OW) From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 12:00 PM																	
12:00 PM	**46**	172	0	218	0	0	0	0	0	**283**	**42**	**325**	**106**	0	74	180	723
12:15 PM	35	197	0	232	0	0	0	0	0	272	42	314	92	0	92	184	**730**
12:30 PM	34	**206**	0	**240**	0	0	0	0	0	243	39	282	83	0	**101**	184	706
12:45 PM	36	196	0	232	0	0	0	0	0	214	25	239	99	0	99	**198**	669
Total Volume	151	771	0	922	0	0	0	0	0	1012	148	1160	380	0	366	746	2828
% App. Total	16.4	83.6	0		0	0	0		0	87.2	12.8		50.9	0	49.1		
PHF	.821	.936	.000	.960	.000	.000	.000	.000	.000	.894	.881	.892	.896	.000	.906	.942	.968
PASSENGER VEHICLES	147	763	0	910	0	0	0	0	0	985	141	1126	371	0	354	725	2761
% PASSENGER VEHICLES	97.4	99.0	0	98.7	0	0	0	0	0	97.3	95.3	97.1	97.6	0	96.7	97.2	97.6
SINGLE UNIT TRUCKS	3	8	0	11	0	0	0	0	0	19	7	26	4	0	9	13	50
% SINGLE UNIT TRUCKS	2.0	1.0	0	1.2	0	0	0	0	0	1.9	4.7	2.2	1.1	0	2.5	1.7	1.8
TRACTOR TRAILERS	1	0	0	1	0	0	0	0	0	8	0	8	5	0	3	8	17
% TRACTOR TRAILERS	0.7	0	0	0.1	0	0	0	0	0	0.8	0	0.7	1.3	0	0.8	1.1	0.6



MAINE DEPARTMENT OF TRANSPORTATION
TRAFFIC ENGINEERING DIVISION
TRAFFIC MONITORING SECTION

BANGOR MOSTLY CLOUDY / SUNNY
HOGAN RD, SPRINGER DR, BANGOR MALL BLVD
RONCO / MOODY / KNOX
1981 / 1982 /2183

File Name : BANGOR-192-TM
Site Code : 19020192
Start Date : 8/26/2008
Page No : 4

	HOGAN RD From North				SPRINGER DR From East				HOGAN RD From South				BANGOR MALL BLVD From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 11:45 AM																	
11:45 AM	8	107	25	140	76	**37**	17	**130**	134	**123**	95	352	**43**	34	109	186	808
12:00 PM	12	115	21	148	63	35	20	118	**147**	117	87	351	36	25	120	181	798
12:15 PM	13	120	27	160	64	32	**21**	117	133	119	**107**	**359**	37	**36**	112	185	821
12:30 PM	**17**	**143**	**31**	**191**	**84**	26	20	130	118	119	77	314	41	33	**129**	**203**	**838**
Total Volume	50	485	104	639	287	130	78	495	532	478	366	1376	157	128	470	755	3265
% App. Total	7.8	75.9	16.3		58	26.3	15.8		38.7	34.7	26.6		20.8	17	62.3		
PHF	.735	.848	.839	.836	.854	.878	.929	.952	.905	.972	.855	.958	.913	.889	.911	.930	.974
PASSENGER VEHICLES	50	475	104	629	283	128	77	488	528	467	360	1355	157	128	467	752	3224
% PASSENGER VEHICLES	100	97.9	100	98.4	98.6	98.5	98.7	98.6	99.2	97.7	98.4	98.5	100	100	99.4	99.6	98.7
SINGLE UNIT TRUCKS	0	9	0	9	3	2	1	6	2	10	4	16	0	0	2	2	33
% SINGLE UNIT TRUCKS	0	1.9	0	1.4	1.0	1.5	1.3	1.2	0.4	2.1	1.1	1.2	0	0	0.4	0.3	1.0
TRACTOR TRAILERS	0	1	0	1	1	0	0	1	2	1	2	5	0	0	1	1	8
% TRACTOR TRAILERS	0	0.2	0	0.2	0.3	0	0	0.2	0.4	0.2	0.5	0.4	0	0	0.2	0.1	0.2